



The animal is a large rat at the knee three days after one injection of 10 cc of a solution of cuprous chloride (50 per cent) and of sodium chloride (30 per cent). Note marked reaction around vein in lower thigh.

INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIAT-
RICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,
OTOLOGY, RHINOLOGY, LARYNGOLOGY,
HYGIENE, AND OTHER TOPICS OF INTEREST
TO STUDENTS AND PRACTITIONERS
BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

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Fitzsimons General Hospital of the U. S. Army*

HELIOOTHERAPY IN THE TREATMENT OF TUBERCULOSIS¹

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THE first great experiment with heliotherapy in tuberculosis was made in the beautiful Alpine country of Switzerland At Leysin, a small Swiss village high up in the mountains, overlooking the Rhone Valley, and surrounded by snow-capped peaks, Doctor Rolher, a pupil of Kocher, started his first clinic in 1903 His results were brilliant and the importance of his work was soon recognized From this one clinic sprung many others, until Leysin became a mecca for heliotherapy, visited by physicians from many parts of the world The whole Swiss nation was affected by what transpired at Leysin during the next few years Sun baths were soon looked upon not only as a valuable therapeutic aid to the tuberculous, not only as a form of treatment which could be used for many ailments, but also as a hygienic procedure for the building up of the body nutrition and resistance, and the prevention of disease In a short time it came to pass that no hospital was considered complete without its sun galleries School children played their open air games in bathing trunks, and men worked in the vineyards unclothed to the waist Rolher taught that the sun healed both by direct action and by improving the general metabolism of the body Tuberculosis, being a general disease, must be treated not only by curing its local manifestations but also by building up the general resistance and nutrition Before the advent of Rolher's teachings, bone, joint, gland and genito-urinary tuberculosis were

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treated largely by means of surgery, which left in its wake many cripples Rollier proved that by using heliotherapy, combined with rest and hygiene, movable joints and useful limbs could be obtained His work represents an epoch in the history of medicine and surgery The climate, location, topography and other features of Switzerland are ideal for the application of heliotherapy An abundance of sunshine, rarefied, pure air, temperate climate and sheltered mountain sides present the best combination of heat, light and chemical rays which experiments would indicate as most favorable for therapeutic results However, Rollier claimed that his treatment could be applied in any part of the world, in the lowlands, at the seashore, as well as in the mountains The effect of the sun's rays is enhanced by reflection on snow, water and sand Sun baths can be supplemented by artificial light from carbon-arc and mercury vapor lamps so that heliotherapy is not limited to the climate of any one locality As this agency in the treatment of tuberculosis came to be used more generally, Rollier's contention was borne out and good reports came from institutions located in various parts of the world, some in climates considered unfavorable according to the general conception of the therapeutic properties of sunlight

In the application of heliotherapy in pulmonary tuberculosis, the results were not so good Different views, based on actual experience, arose concerning its usefulness in such cases Some believed more harm than good was done and in many of the sanatoria at Leysin it was discarded entirely as a method of treatment for tuberculosis of the lungs Yet, in these same sanatoria, patients are encouraged to sit in the sun, exposing their hands and faces and at times the lower extremities Rollier insisted that he obtained good results in pulmonary cases and recommended its employment with certain precautions It is to be remembered that Rollier only treats the surgical forms of tuberculosis in his clinics, and only accepts pulmonary cases when they come to him as a complication in extra-pulmonary forms of the disease As a rule, pulmonary lesions in combination with bone and joint tuberculosis are characterized by their chronicity, and in this way we may explain the variance between results obtained by Rollier and those of others in the same locality

In the United States, as Rollier's work became well known, it was taken up and employed in most tuberculosis institutions. From those treating extra-pulmonary types of the disease, especially those limited largely to tuberculosis of children, brilliant reports were forthcoming. From the many sanatoria, where most of the patients were under treatment for various forms of phthisis, the reports were rather discouraging. Heliotherapy is a spectacular sort of treatment and one that appeals to the imagination of most patients. Many sensational articles on the sun cure have appeared in popular magazines and its merits pictured in the most glowing terms. In consequence it came to be used injudiciously and much harm resulted. Patients employed it without any supervision and physicians prescribed it who had little or no experience with its use in any type of tuberculosis. Recently a number of articles have appeared in the medical literature calling attention to the dangers of heliotherapy, especially in pulmonary tuberculosis.

As the question stands today, heliotherapy is generally accepted on the continent of Europe, in England and in the United States as a valuable agency in the treatment of bone and joint tuberculosis, glandular tuberculosis, genito-urinary tuberculosis and tuberculous peritonitis, in other words, the extra-pulmonary or so-called surgical forms of the disease. To explain its status in the treatment of pulmonary tuberculosis, the experience with this method of treatment at the Fitzsimons General Hospital will be described.

This institution is the Army General Hospital for the treatment of tuberculosis and has a capacity of over 1800 beds. Since 1921 heliotherapy has been quite a feature in the treatment employed here, and every effort has been made to facilitate and develop its use. Denver is on a high plateau, and its rarefied, pure air, cool and dry, with many days of sunshine throughout the year makes it a desirable location for the so-called sun cure. At first sun baths were only used in extra-pulmonary cases and a heliotherapy ward was built where all such patients were collected and kept out of doors continuously on open and sheltered porches. Later various types of sun porches and enclosures were constructed in connection with all wards for the treatment of pulmonary cases. The results obtained in extra-pulmonary forms of tuberculosis are uniformly good and the cooperation, helpful

among those patients were very remarkable. We soon became convinced of the value of the sun in healing such cases and turned our attention to its application in pulmonary tuberculosis. The patients were only too ready to try it and volunteers were plentiful. At first cases were selected which were afebrile, in fairly good general condition and which were not responding well to ordinary treatment. Heliotherapy was applied very cautiously, using half doses as a rule and not exposing the chest until the remainder of the body was well pigmented and the patient doing satisfactorily. The results were not encouraging. About one-third of the patients selected were apparently made worse and it was only continued in a chosen few. Later a number of patients with fibrous lesions were given graduated sun baths and the outcome of this experiment led eventually to our present plan of selecting cases. The therapeutic effect of the sun's rays is based on the following factors:

- 1 Local action (if lesion is superficial) Bactericidal, destruction of tuberculous tissue, increased phagocytosis with absorption of tuberculous and stimulation of the normal tissue in the neighborhood of the tuberculous focus.

- 2 Local action (if lesion is deep seated) A focal reaction similar to a tuberculin reaction produced at a distance from the part exposed.

- 3 General action Stimulation of the skin and all its functions, (stimulation, elimination and absorption), increased metabolism, increase in general nutrition and improvement in the function of the leucocytes and bactericidal powers of the blood.

Bearing this in mind, it was believed that a direct local effect could not be depended upon in the treatment of pulmonary tuberculosis, but the benefit obtained from focal reactions as in tuberculin therapy and the general action on the resistance and nutrition of the patient must be our objective. We learned long ago that tuberculin should be used more as a finishing touch in the treatment of pulmonary tuberculosis. It is a test of the amount of fibrosis which the patient has surrounding his lesions and if given properly, when fibrosis already exists, it may increase the fibrosis, very similar to the auto-inoculation effect of graduated exercise or work. The lung, being a continuously moving organ with many avenues for the spread of the tubercle bacillus, we cannot afford to take the risk

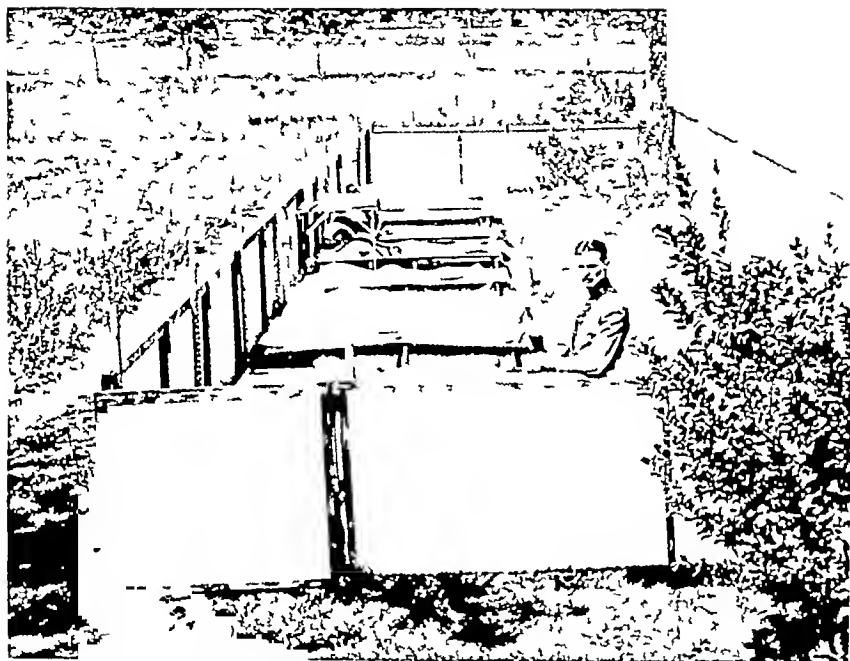
of disseminating the disease in our attempts to destroy the focus which might occur from reactions around lesions not well encapsulated. Except for producing a mild focal reaction, we must content ourselves with the general and not the local effect of heliotherapy. It is of little consequence if heliotherapy produces cold abscesses in bone, joint or glandular tuberculosis. Such abscesses can easily be taken care of, but the same process in pulmonary tuberculosis may mean extensions or cavity formation. Reasoning along these lines, it was finally decided to limit our application of heliotherapy in pulmonary tuberculosis to the treatment of ambulatory patients or those with fibrous lesions and already on graduated exercise. After adopting this policy, heliotherapy assumed a useful rôle in the care of our pulmonary cases and one fraught with little or no danger. From results obtained so far, it is believed that the value of this therapeutic procedure during a certain period in the treatment of cases of phthisis has been definitely established. It is therefore only to be prescribed by the trained specialist after the patient has been under observation for a sufficient length of time and the character of the pulmonary lesion determined by a composite estimate of X-ray findings, physical signs, subjective and objective symptoms under the effect of graduated exercise. It is our plan at Fitzsimons General Hospital to give heliotherapy only to ambulatory patients, taking at least one hour of exercise a day. Thus, while the part played by heliotherapy in the treatment of pulmonary tuberculosis is limited, it is nevertheless a useful and important one.

The care of our tuberculous soldiers as established by Colonel Bushnell over twenty years ago has undergone very few changes. No specific treatment has ever been used, no fads nor any of the much-exploited so-called cures have ever been introduced. It has not been a treatment by drugs or serums aimed at the direct destruction of the tubercle bacillus, but an effort to restore the failing resistance of the body—rest, open air and nourishing food, nothing wonderful and nothing very different from the treatment employed in other tuberculous institutions, but it has withstood the test of time. Pneumothorax therapy and thoracoplastic surgery are now playing their imposing rôle. We have always accepted sunshine as a part of the open-air treatment, but until heliotherapy

was developed in the last two decades, we failed to make full use of the health giving and healing powers of sun baths. Heliotherapy fits in well with rest and open air. It is something that allays the fear-complex of tuberculous patients and immerses their dread of the "great white plague" in the subconscious mind. This is strikingly demonstrated by the excellent morale and cooperation of patients on heliotherapy wards. Instead of pallor, the patient takes on a glistening coat of tan, in place of weakness and emaciation we see robustness and good muscular development, the patient is surrounded by impressions of health instead of sickness. The beneficial psychical effect of the doctor's advice to go West and rough it, without its dangers. We thus support the patient's morale, at the same time building up his resistance little by little while he goes on to a completion of his cure.

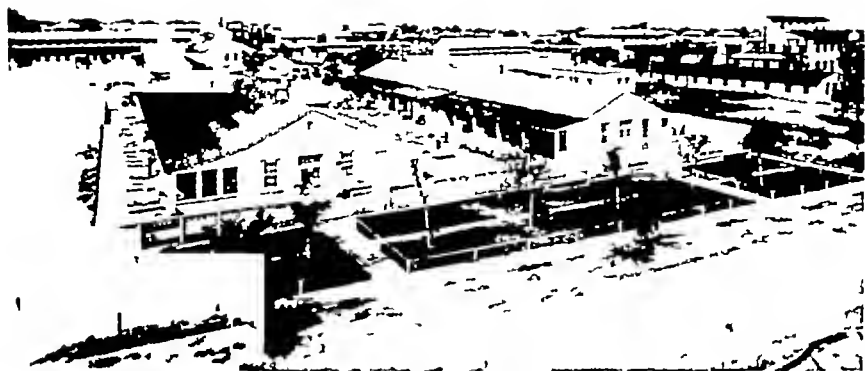
To summarize, heliotherapy, carefully applied, is beneficial in bone and joint, glandular, skin, genito-urinary and peritoneal tuberculosis. In pulmonary tuberculosis more care must be exercised in selecting cases and in applying the treatment. Sun baths are indicated and can be given more safely to patients with quiescent or fibrosing lesions. Cases of artificial pneumothorax or thoracoplasty with contralateral lung not actively involved are also improved by this form of therapy (Figs 1 to 7).

FIG. 1



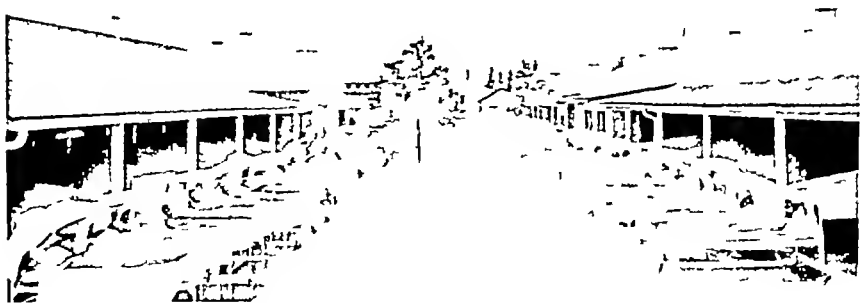
Improvised movable heliotherapy enclosure for tuberculosis wards.

FIG. 2.



Heliotherapy ward Fitzsimons General Hospital

FIG. 3



Heliotherapy platform heliotherapy ward

FIG 4



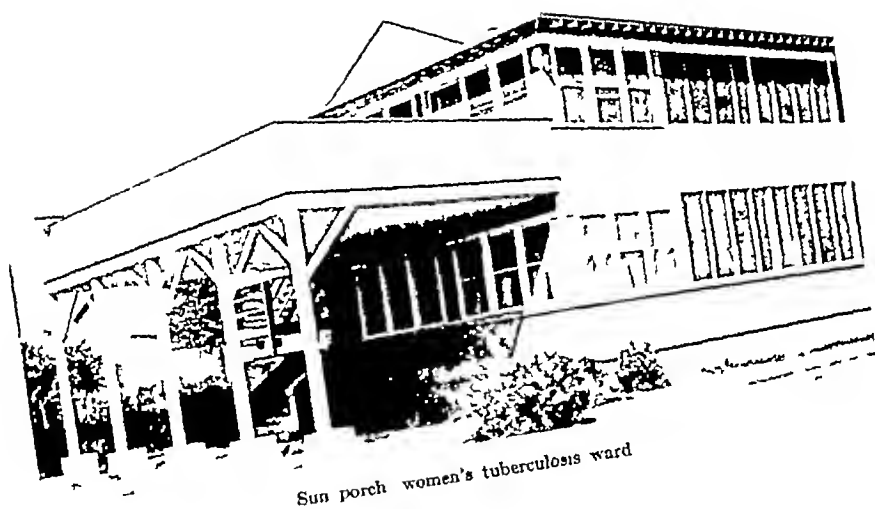
Open air enclosures on heliotherapy ward. Patients remain in these enclosures day and night throughout the year and are only moved inside for bathing

FIG 5.



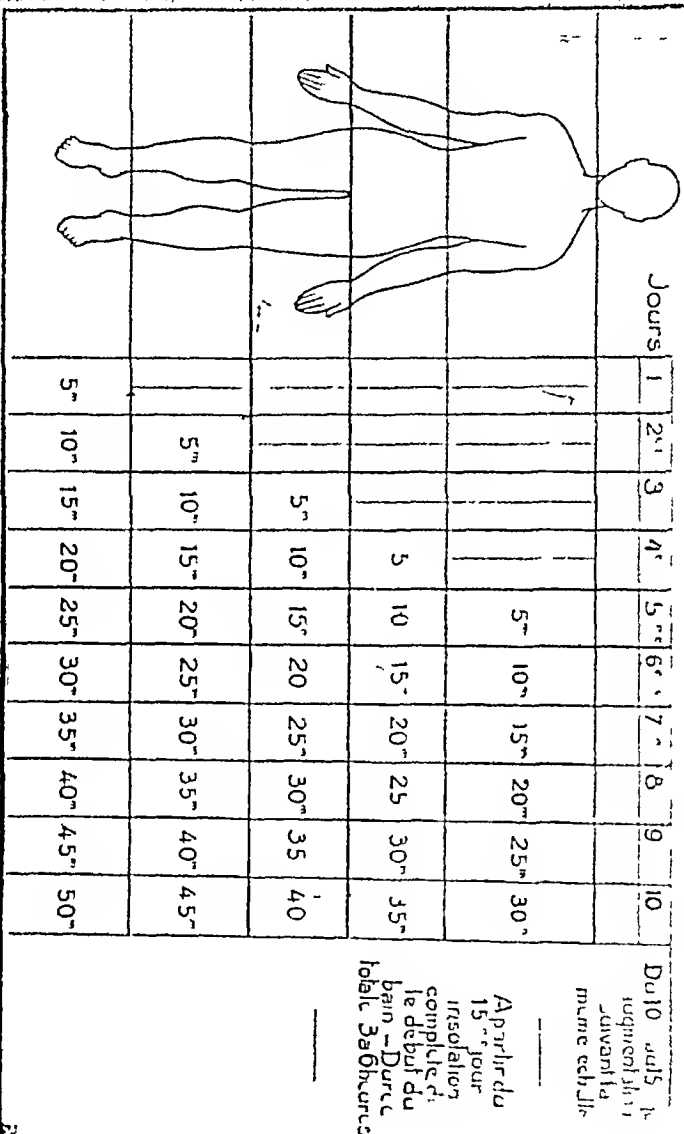
Heliotherapy platform infirmary tuberculosis ward

FIG 6



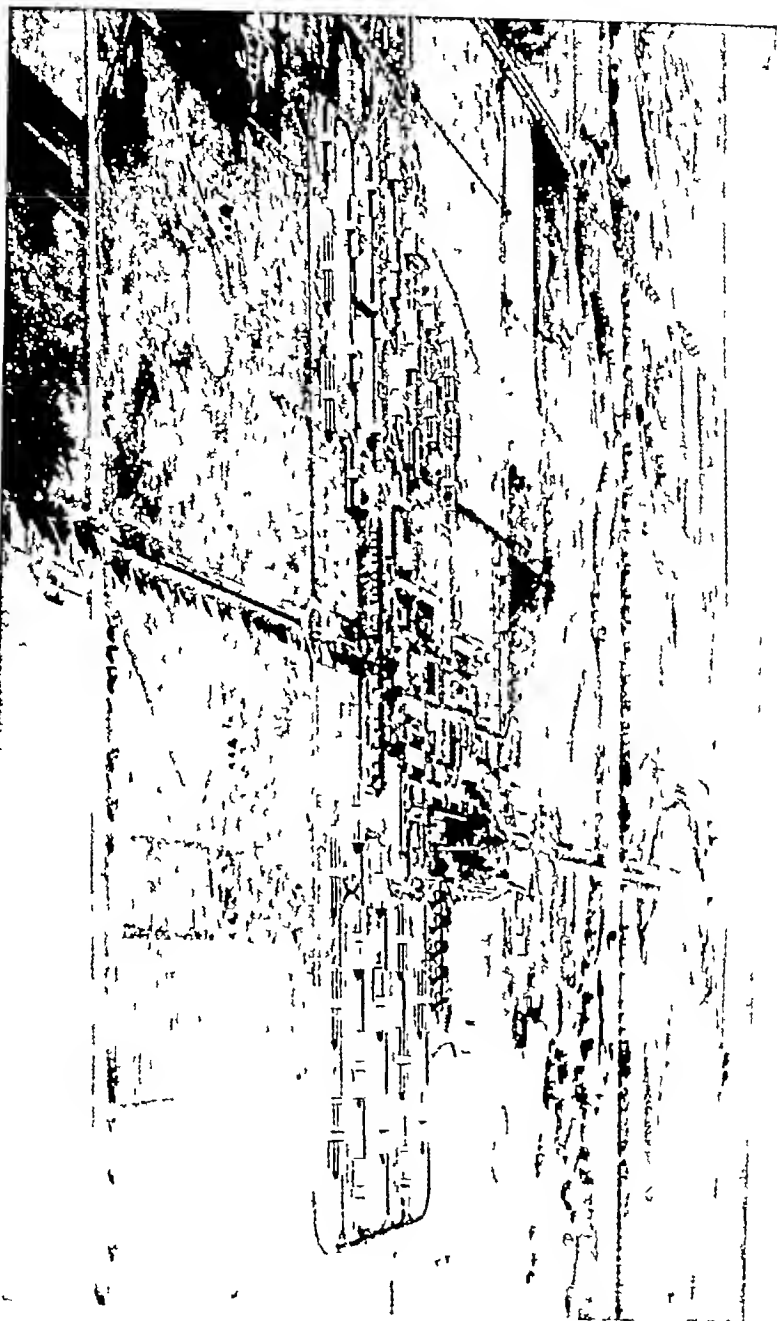
Sun porch women's tuberculosis ward

Fig 7



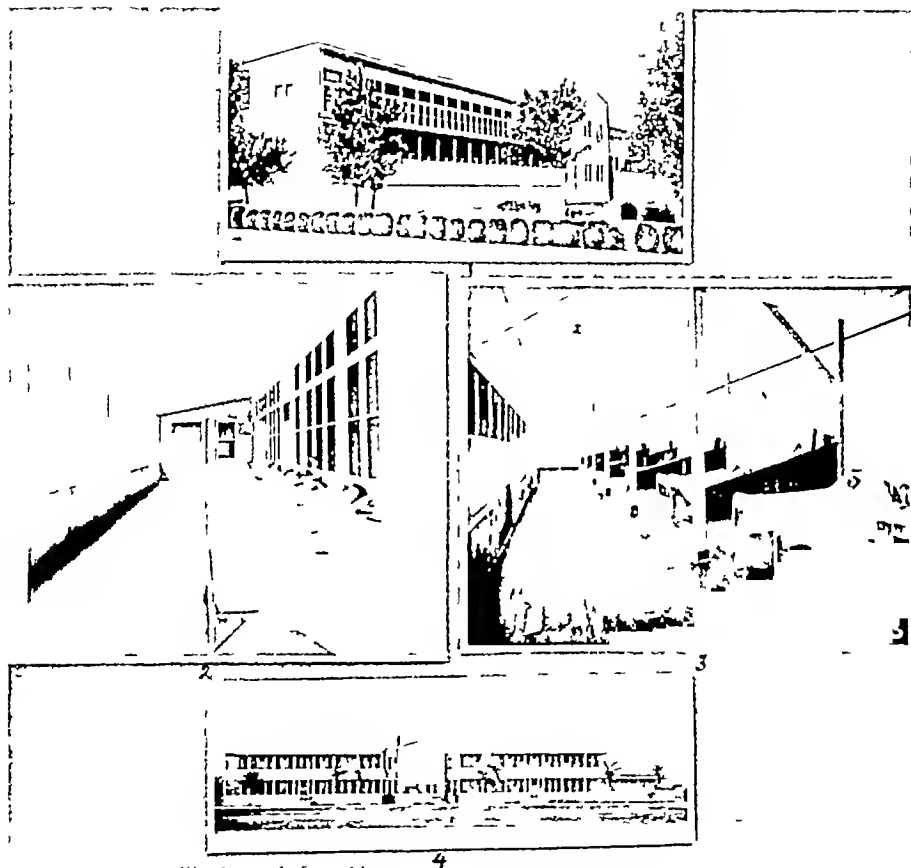
Roller chart for graduated sun baths

Fig. 1



Air view Fitzsimons General Hospital

Fig 2



Tuberculosis Unit Fitzsimons General Hospital

- 1 Ambulatory ward
- 2 Open air gallery infirmary tuberculosis ward
- 3 Open air wings ambulatory ward
- 4 Infirmary tuberculosis ward

THE BASIC TREATMENT OF PULMONARY TUBERCULOSIS AS APPLIED AT THE FITZSIMONS GENERAL HOSPITAL *

By E H BRUNS, M D

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The basic structure of tuberculosis therapy consists mostly of that well-known tripod of treatment, rest, fresh air and nutrition. Other factors are included, but we must begin with and not neglect these three important agents. In order to understand their application we should bear in mind that we are dealing with tuberculosis of the immune subject in which the deficiencies of the immunity, if not too great, can be restored by building up the general health of the patient. This is done by the proper employment of rest, open-air living and nutritious diet.

When an animal which has never come in contact with tuberculosis is inoculated with a sufficient dose of tubercle bacilli virulent for its species, it dies invariably of generalized tuberculosis. If, however, a minute initial inoculation is made, and after sufficient time has elapsed a second and much larger dose is given, the effect is very slight and the animal continues to live. It may eventually die of tuberculosis, but, if it is well fed and kept in its favorite environment, the disease may remain latent and finally heal. Compare the first animal with the young child or the uncivilized adult, receiving, for the first time, a large infection, or, what amounts to the same thing, frequently repeated small infections, the result is similar. They die of acute generalized tuberculosis against which all treatment is of no avail.

Tuberculosis, as it usually presents itself in civilized individuals, occurs in those who have survived the initial, small infections, and have developed an immunity as a result of these infections. This immunity, while unable to eradicate latent tuberculous foci, is capable of keeping such foci latent and preventing the activity and spread of the tubercle bacillus. To do this, immunity must be kept

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at a high degree. If even a slight lapse occurs, tuberculous infections or latent foci may assume the proportions of disease.

The whole problem of tuberculosis is one of immunity. We can only treat the disease through means which restore this immunity or by assisting in every way the protective forces of the body itself against the tubercle bacillus. Improvement in the hygiene of living, increased rest, more fresh air and better food, all incorporated in the routine of sanatorium life, are the principles of treatment. While they may be inadequate in many cases, they are frequently sufficient to restore slight failure of immunity and turn the tide towards recovery. In former times this represented the entire established treatment of pulmonary tuberculosis and was usually only successful in early cases. Many institutions considered advanced cases hopeless, for which nothing could be done, and only accepted for treatment patients in the early stages of their disease.

During the past two decades means have been developed for improving and bringing to arrest advanced cases with cavitation. I am referring to artificial pneumothorax therapy and various other surgical procedures, such as phrenico-exeresis and thoracoplasty. These latter methods of treatment will not be dealt with in this paper.

While the treatment of tuberculosis can be applied at home, in the beginning, at least, it can best be carried out in a sanatorium. No doubt there are advantages in both methods, but this much can be truthfully said about the sanatorium: it is the school of the tuberculous and treatment should therefore be started this way. After the disease has become quiescent, or after the patient has learned fully how he should live, treatment can then be carried out successfully at home.

We make it a rule at this hospital to place all tuberculous patients at rest in bed for at least one month after their arrival. This rest treatment is then continued or modified according to the condition of the patient and the quantity and character of his tuberculous involvement. All patients are required to take their cure on open air porches during both summer and winter and a nutritious, variable and digestible diet is prescribed. Patients are all warned against overeating and are taught to be moderate in their habits. Unless there is some special contraindication, smoking is permitted outside of rest hours. After a patient has become afebrile, with normal pulse

rate, and physical signs together with serial X-ray plates show the development of fibrosis, he is transferred to an ambulatory ward and placed on graduated exercise. This graduated exercise consists of walks, light work around the wards, and various forms of occupational therapy. If his condition improves he is promoted from one class to another, each class advancing the period of exercise one-half hour, up to three hours daily. After patients are able to exercise one hour a day without any ill effects and with indications of improvement, they are usually given graduated sun baths.

The Fitzsimons General Hospital has a capacity of over 1800 beds. Although it is not confined to the care of tuberculous patients alone, as a rule approximately 900 tuberculous patients are under treatment. In institutions of this size there is a tendency for the convenience of administration to treat patients en masse, which is a grave mistake. Small institutions may vary somewhat in their methods of curing tuberculosis, but they usually apply the same basic treatment. One may use to a greater degree than another such measures as tuberculin, heliotherapy or lung collapse therapy, but in the end the results are about the same, because, after all is said and done, the results depend upon the personality of the doctor in charge, and the close personal contact between the physician and the patient. Early in the history of this hospital it was found necessary to do something to promote a more personal interest of the doctor in each patient and a more sympathetic attitude towards them, and at the same time maintain the advantages of a large hospital. Large institutions can be run more economically, can employ orthopaedic, surgical, genito-urinary, neuro-psychiatric and eye, ear, nose and throat consultants, and develop diagnostic and special therapeutic departments on a larger and more elaborate scale than a small sanatorium can afford. The following plan was finally worked out and developed, instead of considering the hospital as one large sanatorium, it was considered as a group or centre of small sanatoria or tuberculosis units. Each unit was looked upon as a separate sanatorium in a centre or group of sanatoria, under one administrative head, but exercising enough independence for all practical purposes and in consistence with the best results in treatment. At the Fitzsimons General Hospital there are now five of these tuberculosis units. In addition there is a surgical unit, an orthopaedic and helio-

therapy unit, a neuro-psychiatric unit, and a general medical unit. Each tuberculosis unit consists of one or two infirmary wards of 100-bed capacity each and an ambulatory ward of 80-bed capacity. In addition some units have a "good-behavior" ward of 28-bed capacity. The infirmary ward is very complete, contains a diet kitchen, examining and treatment rooms, doctors' and nurses' offices, solarium, quiet room, and heliotherapy platform. In such wards provisions are made for heliotherapy, artificial light therapy, pneumothorax treatment, eye, ear, nose and throat treatment, and intravenous therapy. In the diet kitchen food is transferred from food carts to steam tables and a certain amount of cooking is done, such as the preparation of eggs, toast and various simple articles of diet. The ambulatory ward is almost as complete as the infirmary ward except that no diet kitchen is provided, the patients eating in the general mess. The good-behavior ward is used for those convalescent patients who are particularly cooperative in their treatment and wish to be quiet. It is in one sense a reward for good behavior. In this ward each patient has a separate compartment containing a bed, chair, table, and chiffonier. Carrying out the idea of individual, and in order to procure more continuity of treatment, an effort is made to keep patients under the same doctor during their entire stay in the hospital. The advantage of this can readily be seen. The doctor comes to know his patients intimately. He is not only acquainted with their physical condition but learns their mental make-up, their peculiarities, their problems in life, and as a result is better able to treat and influence them. A closer relationship and more personal interest enters into each case (Figs 1 and 2).

As an illustration we will trace a patient during his stay in the hospital. He is admitted through the receiving ward, where he remains 10 days, during which time all examinations are completed. If tuberculosis can be definitely diagnosed, he is then transferred to an infirmary ward, and when his condition permits he is again transferred to an ambulatory ward belonging to the same group. During this time an operation may be required for which he goes to the surgical unit, returning to the same tuberculosis unit after recovery. If he leaves the hospital on furlough or is discharged as "arrested" and later suffers a relapse, he goes to his former unit when he returns. One ward officer is in charge and follows the

patients through their entire treatment. This ward officer does his own pneumothorax work, intravenous therapy and simple eye, ear, nose and throat treatments. He can call in consultants when he so desires. The ward officer has one or more assistants.

As a rule medical officers are assigned to the hospital for a four-year tour of duty. During the first year they serve as assistants and are under training. Another great advantage is to be derived from this system. Our medical officers are not picked men and they have usually had no previous training in tuberculosis work. Some are only average in efficiency, and others are superior and become well qualified in phthisiotherapy. If patients are passed on from one doctor to another, the chain is bound to be weak in spots and is only as strong as its weakest link. One inefficient and indifferent ward officer may ruin the patient. By selecting the officers in charge of units from among the best officers and keeping the patients under the same doctor the chain contains fewer links and is strong. We all know that doctors frequently disagree and if the patient receives the opinion and advice of many different doctors he becomes confused and loses confidence in the treatment. Furthermore, the work of the ward officer is simplified. It decreases the turn-over of patients and means fewer first examinations for each. After reexamining his patients over and over again he soon becomes familiar with the condition of their lungs and can detect slight changes in physical signs.

This system has been in use at the Fitzsimons General Hospital for over six years and has proven its value. There is better cooperation and a more kindly feeling between the patients and doctors. It has succeeded because it is based on the sound principles of continuity and individualization in treatment.

It has been our policy to apply only the generally recognized and accepted methods of treatment. Many so-called cures are exploited from time to time, some of which gain medical recognition, but conservatism and time soon prove their worthlessness. If permitted to creep into our hospitals they weaken the patients' faith in the basic treatment and much harm is done.

One of the great defects in our therapeutic armament is our failure to recognize fully that there is a mental side to our patients. We aim at a cure, but in so doing, we do not want to lay the foundation for neurasthenia. In order to keep their minds occupied we have a

rather complete educational and recreational department conducted more for recreation than as a serious form of vocational training. Bedside occupational work and various forms of amusements such as radios, moving pictures, etc., are provided.

The rôle of climate in combating tuberculosis is a much debated subject. Everything else being equal, it cannot be denied that a dry climate with season changes and a maximum amount of sunshine like that of Colorado is favorable for the cure. While the Army recognizes the importance of climatology and has always located its tuberculosis hospitals with this in view, the part which climate plays in the recovery from tuberculosis has never been exaggerated or emphasized too strongly, as it misleads patients and causes them to neglect the basic principles of treatment.

What is described as the basic treatment of pulmonary tuberculosis is true for tuberculosis involving other parts. It must be remembered that tuberculosis is a general disease with local manifestations and along with the local must go the general or basic treatment which is the same no matter where the disease strikes. Rest, fresh air and nutrition are just as beneficial in genito-urinary, bone and joint and glandular as in pulmonary tuberculosis.

PNEUMOTHORAX TREATMENT IN PULMONARY TUBERCULOSIS *

By ALEXANDER T COOPER

Major, Medical Corps, U S Army

PNEUMOTHORAX TREATMENT IN PULMONARY TUBERCULOSIS

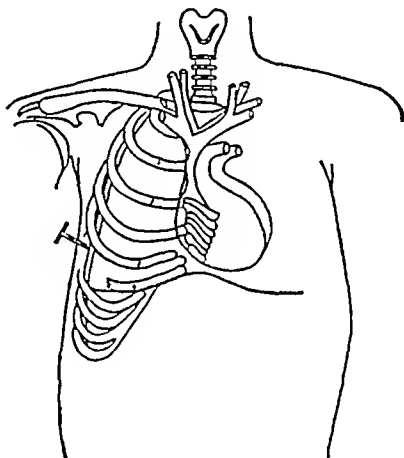
PNEUMOTHORAX is considered a valuable adjunct in the treatment of pulmonary tuberculosis at Fitzsimons General Hospital. This hospital was established October 17, 1918, and the records show that three patients were given an initial pneumothorax during the year 1920, in 1921 six received initial pneumothorax, and the number has gradually increased until during the year 1928, up to October first, forty-seven patients received initial pneumothorax. Patients who were given pneumothorax for pulmonary tuberculosis in addition received the usual hygienic, rest and sanitarium treatment. There are occasions when a patient having received pneumothorax over a number of months, and when all of his pulmonary lesions are considered at least quiescent, is allowed to live at his home, if it is in Denver, and be readmitted to the hospital for forty-eight hours at varying intervals for pneumothorax, the intervals depending upon when, in the judgment of the attending physician, pneumothorax should be given.

It is considered that pneumothorax treatment is particularly indicated where cavities are present and where the tuberculous involvement is mainly unilateral. As a rule all cases in the hospital having cavities as large as two centimetres in diameter, or having heavily involved areas without cavitation tending to spread, and who show no improvement over a preliminary period of rest and hygienic treatment for a period of two or three months, the lesions being predominantly unilateral, are advised to take artificial pneumothorax. Many cases having large unilateral cavitation are frequently given pneumothorax as a palliative measure, and as a rule pneumothorax is also advised and attempted prior to any other surgical procedure, such as an extrapleural thoracoplasty or phreni-

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coexciesis It is believed advisable to try a less severe measure, such as pneumothorax, prior to subjecting the patient to such a major operation as thoracoplasty However, this policy is not without exeptions, as pneumothorax is considered inadvisable in elderly patients who have a considerable amount of disseminated pulmonary fibrosis more or less uniformly scattered throughout their lungs and who may have large cavitation In such cases pneumothorax is almost certain to collapse the less diseased and major functioning portion of the lungs, with little or no effect on the cavities, and extrapleural apicolysis to collapse the cavity, in preference to a pneumothorax, may be advisable

FIG. 1



Schematic drawing of the Fischer cannula showing the introduction of the cannula for initial pneumothorax introduced down to but not penetrating, the parietal pleura

It is well to bear in mind, however, that in a young adult the presence of apparently extensive pleurisy, which appears by X-ray to prohibit any unsuccessful attempt at pneumothorax, may be misleading, and the question as to whether pneumothorax can or cannot be successfully administered can only be determined by attempting pneumothorax. It has frequently been our observation at this hospital that even where the X-ray apparently shows rather extensive pleurisy, pneumothorax has been successfully given after a few attempts

The indications for a pneumothorax are, as mentioned above,

FIG 5



Retouched X-ray negative showing cavitation bilateral in case of pulmonary tuberculosis

FIG 6



Retouched X ray negative showing the results of bilateral pneumothorax with partial collapse of cavities in both upper lobes

FIG 7



Retouched X-ray negative showing selective collapse of the upper portion of the lung with re-expansion of the lower part.

FIG. 8

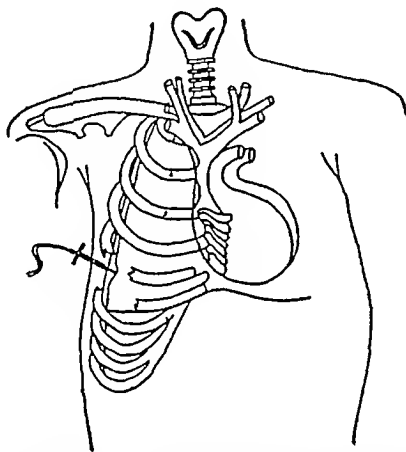


Retouched X-ray negative showing selective unilateral pneumothorax in the case 1090 with definite improvement in the contralateral lung

where the tuberculous lesion is mainly unilateral, with the presence of cavitation or a rather heavily involved area which is tending to spread and has shown no improvement after two or three months' sanitarium observation. However, it is a well recognized fact among phthisiologists that tuberculosis is mainly a bilateral disease and that while the major lesions may be confined to one lung there can usually be demonstrated some slight, nodose, tuberculous involvement in the contralateral lung.

Even where there is considerable involvement of the contralateral lung, with cavitation, this is not in itself a contraindication to pneu-

FIG. 2



Schematic drawing of the Fischer needle showing the introduction of the needle used in initial pneumothorax introduced through the cannula and penetrating the parietal pleura and pushing the lung with its visceral pleura in front of it.

mothorax. Worth-while results have been obtained where the most diseased lung has been collapsed or partially collapsed, and where there has been considerable involvement of the contralateral lung, even with cavitation. After partial collapse of the most diseased lung, it is not an infrequent occurrence that the patient will begin to improve, and X-ray studies of his lungs will show increased fibrosis with some clearing of diseased areas, not only in the collapsed lung, as far as can be ascertained, but also in the contralateral functioning lung. This is shown in the accompanying photographs (Figs 5 to 8).

Pneumothorax, when given, should at all times be cautiously begun. In the presence of a thin-walled cavity which apparently lies contiguous to the visceral pleura, extreme care is indicated as a large initial dose of air may rupture the cavity and cause pyopneumothorax. However, in a lung which is being collapsed by pneumothorax, having cavities which are rather thick-walled and being held open by adhesions, rather massive and frequent administrations of air will stretch these adhesions while they are plastic before they have become markedly fibrous through a prolonged and slow pneumothorax treatment.

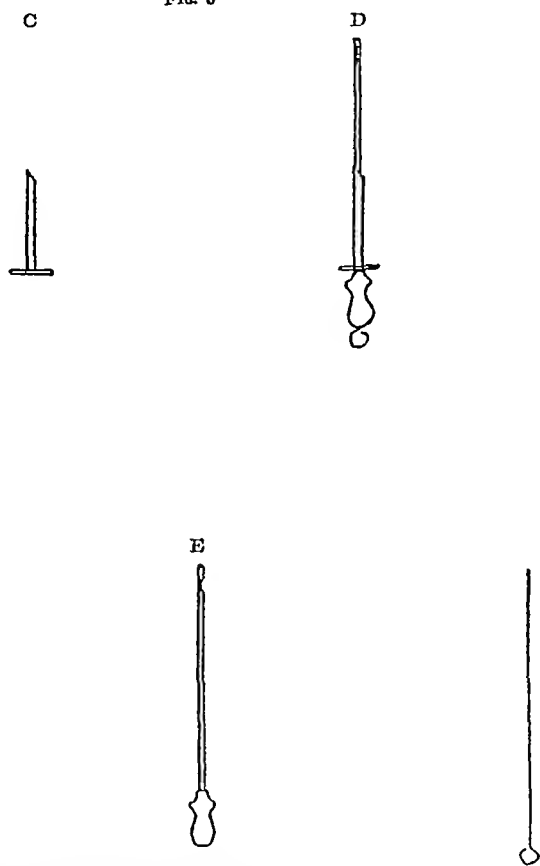
Pneumothorax in cases of hæmorrhage, where there is no question as to where the hæmorrhage is originating in the lung, and the bleeding area can be compressed, is a most rational and successful treatment for this condition. In such cases the initial dose of pneumothorax should be comparatively large, possibly up to 1,000 cubic centimetres of air. We have given pneumothorax successfully to approximately thirty patients to stop pulmonary hæmorrhage since 1921. These were cases in which it could be definitely determined by X-ray from where the hæmorrhage was unquestionably originating.

The results of pneumothorax, where successful and the diseased portion of the lung collapsed, are such that patients are greatly encouraged, their appetite increases, color improves and cough lessens, and the tuberculous toxæmia is not so evident. The sputum, which may have been rather profuse and was positive for tubercle bacilli, is lessened considerably and may become negative for tubercle bacilli. It frequently is observed that lessening of the tuberculous area in a lung by compression is of clinical benefit to tuberculous involvement in other portions of the body, such as tuberculosis of the larynx or intestines.

Bilateral pneumothorax has been successfully used at this hospital. The method of procedure is to induce pneumothorax on the most involved side, and if the procedure is to be successful a fairly complete collapse of the lung is obtained. The lung is then allowed to slowly reexpand. If necessary, small amounts of air can be withdrawn at sittings to aid in reexpansion of the lung. It is found that the least diseased portion of the lung will reexpand first, leaving the most involved portion of the lung collapsed. By this means it is pos-

sible to then continue the collapse of the most heavily involved area, particularly if it is at the apex, while the lower portion of the lung, or the uninvolved portion which has been allowed to reexpand, can

FIG. 3



C Shows Fischer cannula used in initial pneumothorax.
 D Shows Fischer initial pneumothorax needle inserted through the cannula with the stylet in place.
 E Shows Fischer initial pneumothorax needle in two positions and the stylet.

now carry on its physiological function. This procedure is then followed on the contralateral lung. As a final result there will be compressed the involved areas usually containing cavities of each lung, which are partially or wholly collapsed by pneumothorax, the remaining portion of both lungs, which is not so heavily diseased, functioning. This procedure of collapsing the entire lung and then, slowly permitting the lesser diseased portion to reexpand by

tinuing the injections of air, or withdrawing air after collapse, is followed when it is desired to obtain selective pneumothorax. The accompanying photographs show a case where bilateral pneumothorax was obtained (Figs 5 and 6)

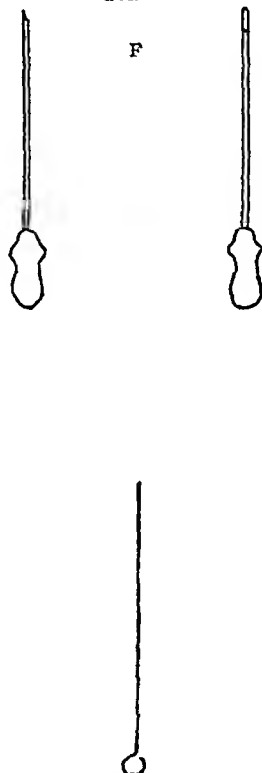
In a recent study of the number of patients who were given pneumothorax treatment it was found that since 1921 there were approximately 472 patients in whom pneumothorax has been successfully attempted up to June 1, 1929. In this study it has been found that more satisfactory results are obtained where satisfactory collapse is secured and this collapse is maintained for eighteen months or longer. It is found that in patients with so-called unilateral tuberculosis, who received pneumothorax treatment for six months or less, only 24 per cent were improved and 76 per cent were unimproved. In cases who received pneumothorax treatment for from six months to one year, 48 per cent were improved and 52 per cent were unimproved. Of those who received pneumothorax treatment for from one to two years, 61 per cent were improved and 39 per cent were unimproved. In those who received pneumothorax for from two to three years, 64 per cent were improved and 36 per cent were unimproved.

A satisfactory collapse is an important element to be considered. Of those who received pneumothorax treatment for six months or less, but who had a satisfactory collapse, 27 per cent were improved and 73 per cent were unimproved. Of those who received an unsatisfactory collapse, 21 per cent plus were improved and 78 per cent plus were unimproved. Of those who received pneumothorax for from six months to a year, having obtained a satisfactory collapse, 57 per cent were improved and 43 per cent were unimproved. In those in whom an unsatisfactory collapse was obtained, 33 per cent were improved and 67 per cent were unimproved. In those who received pneumothorax treatment for from one to two years and obtained a satisfactory collapse, 67 per cent were improved and 33 per cent unimproved, while in those with an unsatisfactory collapse, 44 per cent were improved and 56 per cent unimproved. In those who received pneumothorax treatment for from two to three years, a satisfactory collapse having been obtained, 63 per cent were improved and 37 per cent unimproved. It is to be noted that even

in those who received an unsatisfactory collapse during this length of time, 67 per cent were improved and 33 per cent unimproved

Spread to the contralateral lung is apt to occur in a small percentage of cases, 7 to 22 per cent, regardless of whether there is a satisfactory collapse or not. The decrease in cough and sputum

FIG. 4



Shows Fischer refill pneumothorax needle in two positions and the stylet

became more noticeable as the pneumothorax was prolonged, and where it was continued from one to two years with a satisfactory collapse decrease in cough and sputum became noticeably lessened in 64 per cent. This also was evident in 44 per cent of the cases in which pneumothorax treatment was prolonged one to two years, even with an unsatisfactory collapse.

Even in frank cases of bilateral pulmonary tuberculosis, as noted before, pneumothorax treatment is not contraindicated. Thirty-one per cent of such cases who received pneumothorax treatment for six

months or less were improved and 69 per cent were unimproved, and there was improvement in the contralateral lung in 16 per cent, as shown by X-ray. In those with bilateral pulmonary tuberculosis who received pneumothorax treatment six months to one year, 40 per cent were improved and 60 per cent unimproved, and there was improvement in the contralateral lung in 13 per cent, as shown by X-ray. In those with bilateral pulmonary tuberculosis who received pneumothorax treatment one to two years, 59 per cent were improved and 41 per cent unimproved, and there was improvement in the contralateral lung in 34 per cent, as shown by X-ray. In those with bilateral pulmonary tuberculosis who received pneumothorax treatment for from two to three years, 57 per cent were improved and 43 per cent were unimproved, and there was improvement in the contralateral lung in 57 per cent, as shown by X-ray.

As to when the lung should be permitted to reexpand must be decided by the clinician from symptoms, the condition of the lung previous to the beginning of artificial pneumothorax, and the general condition of the patient. As a rule, with smaller cavities not over 4 centimetres in diameter, and where not over 25 per cent of the lung has been involved, a satisfactory collapse having been maintained over a period of two to three years, the patient being symptom-free, well nourished, with an absence of tubercle bacilli in his sputum, the lung can be gradually allowed to reexpand by discontinuing the giving of air, or gradually lengthening the time between pneumothorax administrations. It has been found here that in studying cases in which the lung had been allowed to reexpand under these conditions noted above, in approximately 89 per cent the lesions were arrested and there was no reactivation of former active lesions.

Complications which may arise during the administration of artificial pneumothorax are not to be disregarded. Forty-six per cent of our patients receiving pneumothorax developed hydrothorax to a sufficient extent for the ward physician to make a clinical diagnosis of this condition, and 10 per cent of those who developed hydrothorax subsequently developed pyopneumothorax. Spontaneous pneumothorax may be a complication secondary to the artificial pneumothorax. Eight per cent of our pneumothorax treatment patients developed a spontaneous pneumothorax, and of those who

had this complication, pyopneumothorax developed in 55 per cent, and a permanent bronchial fistula remained in about 35 per cent. Of those who developed spontaneous complicating artificial pneumothorax, 35 per cent developed only a serous fluid and no other serious complications. Nine per cent with a spontaneous pneumothorax complicating artificial pneumothorax died suddenly because of a probable air embolism. Air embolism is a serious complication. It may come suddenly where there are many adhesions, where the lung is punctured, or where adhesions are torn which contain the capillaries of pulmonary veins. This complication can be lessened by care-

	No of cases given pneumothorax	Unilateral tuberculosis				Bilateral tuberculosis						Discontinued unsatisfactory clinical course	Decrease in cough and sputum	Sputum became negative	Still in hospital	Left hospital no subsequent record	Dead
		No of cases	Improved	Unimproved	Spread in contralateral lung	No of cases	Improved	Unimproved	Retraction—other lung	Improved—other lung	No change—other lung						
Satisfactory collapse	205 49%	104 57%	54 52%	50 48%	15 14%	101 43%	56 56%	45 45%	21 21%	28 28%	52 51%	27 13%	112 55%	101 49%	105 51%	85 41%	15 7%
Unsatisfactory collapse	213 51%	78 43%	22 28%	56 72%	7 9%	135 57%	38 28%	97 72%	41 30%	19 14%	75 56%	75 35%	69 32%	56 26%	126 59%	38 18%	49 23%
Total	418	182 43%	76 42%	106 58%	22 12%	236 56%	94 40%	142 60%	62 26%	47 20%	127 54%	102 24%	181 43%	157 38%	231 55%	123 30%	64 15%

ful technique and the using of blunt pneumothorax needles. Air embolism may also occur in refills, probably because of a tearing of an adhesion, as noted above, or puncture of the lung by the pneumothorax needle. It has been noted to occur even prior to the introduction of any air when an artificial pneumothorax has been present, and then is probably due to a communication established between the air present in the pleural cavity and pulmonary veins.

The following table shows a summary of the study of 418 cases who received pneumothorax treatment in this hospital over a period of six months to four years, and represents the administration of approximately 12,000 refills.

TECHNIQUE OF PNEUMOTHORAX

The pneumothorax needle now used here was introduced to Fitzsimons Hospital during the past year by Colonel Bruns, Chief of the Medical Service, originating, as far as can be ascertained, with Doctor Fischer, Medical Director of the Baumgartnerheitspital, Vienna. These needles (Figs 3 and 4) may be described as follows:

A short cannula, three and one-half centimetres long, with a flat top, as shown in drawing, Fig 3, C This cannula is hollow and sharp with a diameter sufficient to admit the needle, as shown in E, which is the second needle used in initial pneumothorax The needle (E) consists of a hollow, blunt needle with a suitable metal end to which connection can be made by rubber tubing running to the pneumothorax apparatus, either directly by rubber tubing or through a Luer connection This needle fits snugly into the cannula, has a blunt end, with a lateral opening along the side so that air can be introduced through this needle into the pleural space The refill needle is shown in Fig 4, F It is similar to the needle used on initial pneumothorax, but has a sharp point so that it can be directly introduced through the chest into the pleural space of an existing artificial pneumothorax, and without the use of the original cannula The assembled initial needle with cannula is shown in Fig 3, D

The technique of initial pneumothorax is as follows A careful clinical study having previously been made, including X-ray, the patient is prepared for operation following the usual surgical, anti-septic procedures The operator wears gloves and a sterile gown The site is anesthetized by $\frac{1}{2}$ per cent novocaine solution down to and including the parietal pleura The cannula, as shown in Fig 3, C, is then introduced down to but not through the parietal pleura, as shown in schematic drawing, Fig 1 It requires a certain amount of discernment and good judgment on the part of the operator to gauge the distance so that this cannula will be introduced only far enough not to puncture the parietal pleura When this is done, the needle, E, having been connected with the pneumothorax machine, is introduced into the cannula and is forced down through the parietal pleura A distinct snap can be felt as this needle goes through the pleura It is to be noted that this needle has a blunt end with the opening laterally so that the lung does not tend to be punctured but is pushed away and the air is admitted from the side of the needle (see schematic drawing, Fig 2), thus also preventing occlusion The operator can easily ascertain when he is in the lung by a pleural reading obtained on the manometer A typical pleural reading shows on the minus side and will swing from approximately minus 2 to minus 5 or 6 However, this may vary, depending on the deepness of respiration A pleural reading in initial pneumothorax previous to the

introduction of air, in the absence of a spontaneous pneumothorax, never swings equally from the plus to the minus side, and is never plus. A pneumothorax reading which swings equally to the plus side and the minus side is an almost certain indication that the lung has been punctured and you have a lung reading, or cavity connecting with the bronchus. A plus reading may be found in spontaneous pneumothorax and is frequently induced intentionally when it is desired to separate pleuritic adhesions.

In initial pneumothorax 300 to 500 cubic centimetres of air are introduced, a check on the manometer reading being taken at the end of every 100 cubic centimetres and charted. At the completion of pneumothorax the patient is examined by fluoroscope or an X-ray taken and the outline of the lung is drawn on a chart showing whether pneumothorax has been successfully induced, as far as is able to be determined by X-ray or fluoroscopic examination. In refills, fluoroscopic examination is made prior to and immediately after the giving of the air and a drawing made on appropriate chest chart showing the position of the lung, both prior to the giving of pneumothorax and after. Needle Fig 4, F, for refills, is used after the operator has determined by fluoroscopic examination just where the pneumothorax is and how much space there is between the pleural layers. If there is suitable space, this needle, after anesthetizing the skin by novocaine, as previously described, is introduced directly into the pneumothorax cavity and air administered. The needle, of course, is connected with the pneumothorax apparatus prior to admission. Air is introduced in refills in quantities of 100 cubic centimetres and then the pleural reading is taken on the manometer, which is part of the pneumothorax apparatus. Readings are taken after the introduction of every 100 cubic centimetres of air and are charted. Unless it is desired to separate adhesions, the administration of air into the pleural cavity is stopped when the manometer registers zero on inspiration. A pneumothorax may be given until the manometer registers on the plus side during inspiration, if it is desired to try to separate adhesions. It has been found, where adhesions are present, that larger refills at the beginning will be more apt to stretch the adhesions than if a pneumothorax is slowly prolonged over a longer period, because at the beginning the adhesions seem to be less fibrous and more easily stretched if larger amounts of air are given.

HELIO THERAPY IN THE TREATMENT OF EXTRA-PULMONARY TUBERCULOSIS *

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HELIO THERAPY as used by us is confined almost entirely to the treatment of extra-pulmonary tuberculosis and we think it very important that it should be considered as simply another factor in the treatment of these conditions rather than as a method of treatment. For it is just as important that patients taking heliotherapy get the other well-recognized routine hygienic treatment as used in first-class sanatoria.

In the treatment of all the conditions listed below it is to be understood that the patient is kept strictly in bed during the acute phases of his trouble and we believe that many of the benefits from heliotherapy will be lost, even in mild cases, if this precaution is not taken.

INDICATIONS FOR HELIO THERAPY

I think we may say briefly that heliotherapy is beneficial in almost all chronic debilitating diseases but it is in extra-pulmonary tuberculous lesions that it reaches its greatest usefulness.

CONTRAINDICATIONS FOR HELIO THERAPY

Acute disease of any kind or acute exacerbations of chronic disease, cardiac insufficiency, acute nephritis or bilateral renal tuberculosis so severe that uremia threatens. Ascites or œdema from any cause, pulmonary tuberculosis before the stage is reached where a certain amount of exercise is beneficial and all cases that are desperately ill from any cause.

Heliotherapy is efficacious for the following conditions, in the order named:

- 1 Serous tuberculosis (except synovitis of the knee)
- 2 Tuberculous enteritis

* Published with permission of the Surgeon General, U S Army

- 3 Glandular tuberculosis
- 4 Bone and joint tuberculosis without sinus formation
- 5 Genito-urinary tuberculosis, except the kidneys and excepting also the bladder if that is being constantly reinfectd from a diseased kidney
- 6 Tuberculosis laryngitis, if it is not complicated by severe pulmonary tuberculosis
- 7 Bone and joint tuberculosis with persistent draining sinuses
- 8 Synovitis of the knee without bone involvement (for some reason, contrary to what one might expect, this is very resistant to treatment)
- 9 Tuberculous anal fistulæ (these usually become quiescent clinically very readily, but they are not truly quiescent as they drain a little at irregular intervals and the tubercle bacillus is often found in this drainage)

TREATMENT OUTLINED

Patients with tuberculosis of the spine are treated as bed cases as long as there is any pain or tenderness and until the X-ray shows considerable healing. They are immobilized by the use of a plaster trough, (Figs 1 and 2), and while they are very active they are only rolled out of this once in twenty-four hours for a back-rub and bath. As the disease becomes quiescent they are rolled out for sunning the back and from that time on they gradually dispense with the trough and are allowed to assume the ventral position at will.

After the symptoms have disappeared for several months and the X-ray report concurs with the symptoms, the patient is very gradually allowed to get up and about with the use of the celluloid jacket.

This is made over a plaster cast of the patient's trunk and is glove-fitting. It usually takes about a year for the average adult case to become quiescent under this treatment but he is advised to stay in hospital another year or two and at the end of that time to gradually dispense with the use of his jacket. Instructions are given him for exercises intended to strengthen the back muscles and if these are carried out conscientiously he will usually have no trouble in dispensing with the jacket.

The sun is administered by the method of Rollier and the maximum exposure is usually two hours in the summer and three in the winter, one-half of this exposure being on the front and the other half on the back

TUBERCULOSIS OF THE HIP

Patients with this condition are treated as absolute bed patients until all symptoms subside and until the X-ray shows considerable healing. If the pain on slight movement is great during the active stage a posterior splint may be used for a week or two, but the great majority of cases will be made comfortable with only an extension of from five to ten pounds. This weight is applied continuously through an anklet and knee band (Fig 1). If the man is heavily muscled and the condition very active, more weight must be applied, and if this is the case, a Bucks extension apparatus had better be used as the anklet causes considerable discomfort if more than ten pounds is applied through it.

If there is deformity, the line of pull is applied along the line of deformity, the direction of the pull being gradually changed in such a way that it will have a tendency to bring the limb into its normal position. It is surprising to see how quickly most of these deformities that have not ankylosed can be corrected under the influence of the sun and this small constant pull.

If there is a tendency for the head of the femur to slip upward and outward, then the limb must be held in wide abduction in addition to the traction.

In some cases where fibrous ankylosis has occurred or where contractors are of long standing, it may be necessary to give an anæsthetic and correct the deformity by force, doing tenotomies as necessary. After operation these cases are put up in a double plaster spica with the deformed limb in an overcorrected position. In a few weeks they will be ready for the treatment indicated above.

Foot drop must be guarded against as long as the patient is unable to exercise the muscles involved in this condition himself. We have a special anklet combining the pulley foot drop features that we use when called for (see Fig 1). In addition massage and active movements are used on the muscles when the hip will allow it without protest.

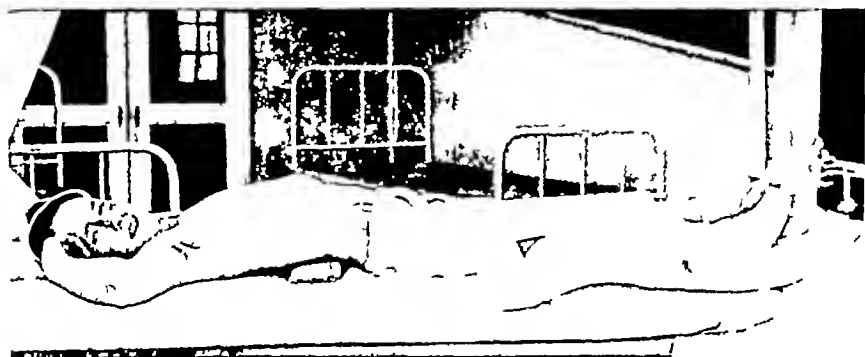
FIG 1



This illustration pictures the process of making the celluloid jackets used in the treatment of our spine cases. The cast at the extreme right is as it was removed from the patient. The next to the left of this shows the cast covered with stockinette and with a coat of celluloid applied. In the center cast the jacket has been completed so far as the application of celluloid is concerned and is ready to be trimmed and removed from the cast by splitting down the front as has already been done in the two jackets at the left. The completed bound end with the eyelets placed and the ventilation holes punched is shown at the lower right.

The apparatus hanging at the extreme left on the white background is an ankle cuff used for applying extension in hip cases. At the right of this is the combination foot drop apparatus used in cases of tuberculosis of the knee where an apparatus is needed to prevent foot drop. To the right of this is the celluloid aeroplane splint used in emphysema of the shoulder. To the right of this is a small celluloid splint which is made of the part and suitable for immobilization of the knee in children. On the far left is a cast of the neck and shoulders over which we make celluloid neck collars for cases of cervical tuberculosis.

FIG 2



At the bottom of the bed is the plaster cast that this boy used during the acute stage of his disease and under his back can be noted the padded board which he now uses to help overcome his deformity. This boy weighed 90 pounds on admission eighteen months ago and his whole back was one large kyphus. While he has not been weighed he must weigh 125 or 130 at this time. The board we use over the spring to keep the mattress from sagging can be noted in this picture but is not mentioned in the text.

FIG 3A



FIG 3B



This is a print of an X-ray of the boy mentioned in the text with a tuberculous hip who had practically no limitation of motion upon being discharged from the hospital after two years of treatment. Fig 3A shows the condition of the hip on admission and Fig 3B shows the condition on discharge. Note that practically a new head had been regenerated.

When there have been no subjective symptoms for several months and the X-ray shows considerable healing, the patient is allowed up on crutches without splints or apparatus of any kind, and after he has been on crutches for a few months weight-bearing is allowed if it causes no discomfort.

Under this treatment many hips will heal with considerable function even in adults and the boy whose X rays are shown below has only very slight limitation of flexion and external rotation, due I think, solely to the deformed head of the femur. The tubercle in this case had evidently started in the epiphysis which accounts for the deformity. (Figs. 3 A and 3 B.)

About fifty per cent. of our cases, taking them as they come to us, heal without ankylosis, but they have varying degrees of limitation. The percentage healing without ankylosis would be much greater and the loss of functional movements would be much less if we got all cases early in the disease. (Fig. 4.)

SHOULDER OR HUMERUS JOINT

These cases are treated in abduction and the immobilizing apparatus is designed so as to leave as much skin exposed for sunning as possible. During the acute stage they are kept in bed and I either use some form of triangular splint in the axilla or keep them abducted with the pulley applied through adhesive straps. After the pain and all discomfort disappear and the X ray shows quiescence the patient is allowed up, the arm being supported by an axillary splint. This splint is made of celluloid reinforced with a small steel band running along the under surface of the arm and down the side. The illustrations, Figs. 5 and 6, are self explanatory. The patient wears this until there is no pain on quite vigorous movement or until the joint is firmly ankylosed.

About half of these cases heal with considerable functional movement. The object of putting them up in abduction is to give them some movement through the scapular range in case they heal by ankylosis.

NECK JOINT

These are treated in gentle flexion and a webbing strap about the neck and fastened to another strap about the wrist is all that is neces-

sary in the way of immobilization I gradually pull up these straps until the hand is in a position to grasp the thyroid cartilage between the thumb and forefinger As healing takes place the strap is gradually lengthened but the joint must be flexed to its fullest extent several times daily during this period until finally the strap is discarded Most of these cases heal with considerable motion

WRIST JOINT

These are treated on the cock-up splint during the acute symptoms and the patient is treated in bed while the symptoms are at all bothersome These joints usually do not ankylose but there is considerable loss of motion when healed

KNEE JOINT

The same principle is used in treating the knee as described above for the hip joint except so much weight is not required and the extension is applied through an anklet alone They are treated as bed cases while the knee is painful and until the X-ray shows the healing process well advanced. They are then allowed up on crutches and weight-bearing is gradually allowed

ANKLE

I immobilize the ankle by the use of a posterior plaster trough extending up over the heel and the bottom of the foot fastened on by webbing straps This can be removed for sunning after the very acute symptoms subside They are allowed up, gradually take on weight-bearing under the same indications and in the same manner as described above for the other weight-bearing joints

TUBERCULOUS PERITONITIS AND ENTERITIS

These diseases are treated by general heliotherapy and patients are kept strictly in bed until quiescent In the beginning of the treatment, if the case is at all active, the abdomen is covered during the exposures until the acute symptoms have subsided This will usually be by the time the patient has a good coat of tan elsewhere. When the exposure of the abdomen is begun, one minute on the first day is sufficient and the exposure is increased one minute daily, until the abdomen is getting the same exposure as the rest of the body If the

precaution of covering the abdomen is not carried out in this type of case the condition will be made worse instead of better, and in those enteritis cases tending to bleed a severe and dangerous hæmorrhage may result

In enteritis cases with severe symptoms a pneumo-peritoneum is given and maintained until the condition becomes quiescent. This controls the distressing symptoms in most cases and I believe hastens the cure. I use, in addition, tuberculin treatment in all cases after the symptoms become quiescent, if there is no active pulmonary lesion. It should not be used, however, in enteritis cases as long as there is a tendency to hæmorrhage.

GENITO-URINARY TUBERCULOSIS

We are handicapped in the treatment of this disease because we are unable to make a diagnosis until the focus has ruptured through into the kidney pelvis and become an open case. For this reason, it is imperative that tuberculosis of the kidney should be suspected at all times and cystoscopies with pyelograms and guinea-pig inoculations of the ureteral urine made.

That the kidneys are able to cope with tuberculosis before it becomes an open case is indicated by the autopsy findings at this hospital, for we often see healed lesions in the kidney substance but very seldom do we see healed lesions in the kidney where its pelvis has become involved.

Tuberculosis of the kidney, as well as tuberculosis elsewhere in the genito-urinary tract, has a tendency to spread throughout that entire apparatus and it is often-times impossible to tell whether there may not be a small focus in the prostate or the vesicles or even in the other kidney, but notwithstanding this fact, all cases that have come under my observation who have had a nephrectomy have done so much better than those who have not been operated that I advise it in all cases in addition to heliotherapy treatment. Even if the tuberculosis is bilateral and one kidney is much worse than the other, I advise operation on the worst kidney, if the better kidney is able to carry on kidney function for the body. This advice is contingent, however, upon the fact that except for the kidney condition the case cannot be considered terminal.

Moderate involvement of the prostate or bladder does not constri-

tute a contraindication to operation, as these cases will often heal up this condition if the kidney condition is removed

These cases should have heliotherapy and sanatorium treatment for a year after operation and if the case is not too pressing, I give them three months heliotherapy before operation to improve their general condition. Tuberculosis of the bladder, prostate and epididymis are all treated by rest in bed during the acute stages and by general heliotherapy. I also use tuberculin if not otherwise contraindicated after the case begins to become quiescent. No operations are done on these organs as there is great danger from tuberculous meningitis and the condition for which the operation is done is seldom helped by it.

ANAL FISTULÆ

While anal fistulæ become clinically quiescent rather quickly under heliotherapy, they do not completely heal so readily, and do, in fact, remain active as they discharge at times a few drops of pus heavily loaded with tubercle bacilli, even though they may heal over on the outside in the interval. I treat these cases by general heliotherapy, bi-weekly injections of bismuth paste and tuberculin, when not contraindicated by a pulmonary condition. If they do not heal under this treatment in a few months, I advise operation. We dissect out the sinus tract with the cautery knife or destroy it with the actual cautery, then keep it packed and give heliotherapy until it heals.

COLD ABSCESSSES

We endeavor in these cases to keep the abscess from pointing and rupturing by immobilization of the involved area, rest in bed, and by not applying heat or poultices of any kind. If, in spite of our precautions, the abscess points, we aspirate it as often as it fills. And in this way, in the great majority of cases, we can keep it from rupturing and the symptoms from it will disappear. I aspirate by making the opening through the skin at a different level from that in the fascia and from such an angle that when the patient assumes his normal position in bed the puncture through the skin will be on a higher level than that in the abscess wall. This is to prevent seepage through the needle tract which usually leads to suppuration. We also go through at least two inches of healthy tissue before entering the abscess cavity.

TREATMENT OF DRAINING SINUSES

While we try in all ways to keep a closed tuberculous abscess from draining, when it does drain and becomes secondarily infected it must be opened widely in a dependent portion. Heliotherapy is continued and the sinus tract is syringed daily, or several times daily, with Dakin's solution or some other antiseptic. If the discharge has a tendency to become thick and block the tract I syringe the sinuses with five per cent sodium chloride carrying one-half per cent sodium citrate. This causes a flow of lymph into the sinus which, being kept fluid by the sodium citrate, flushes it out.

When the sinus tract holds no more than ten or fifteen cubic centimetres, and sometimes if larger, if the discharge has practically stopped, I begin injecting them with sterile Beck's paste and they will often heal under this treatment. As these large sinus tracts will cause death by amyloidosis if allowed to drain too long, even though there may be no symptoms of suppuration except a very slight drainage, every effort should be made to close them as soon as possible and inasmuch as the amount of drainage gives no indication of the extent of the sinus, it is necessary to inject them with some opaque fluid and to take pictures in order that the location for incision at a dependent portion can be truly determined. I use an iodized oil made at this laboratory by the method published by Blance and Livesay in *The American Review of Tuberculosis*, vol 8, No 5, May 1928. This oil may be injected in any location without causing toxic symptoms. I have used as high as five hundred cubic centimetres at one time without symptoms and there seem to be no symptoms if the sinus leads into the intestines or stomach, providing they are promptly emptied. Care must be taken, however, in injecting a sinus coming from the dorsal spine that the patient is not strangled by a large volume of the fluid and pus emptying through a bronchial fistula into the lungs. This condition, where one end of a perispinal abscess empties into the bronchial tree and the other end empties by a sinus through the skin, is not at all uncommon and even this may be injected with an ounce or two of this solution without danger or symptoms other than coughing.

In order to get a true picture of the sinus tract by the use of an opaque fluid a certain technique must be followed. The fluid

must be injected under pressure and must be held under pressure while the picture is being taken. Moreover, considerable time must be used in making the injection because certain parts of the tract are often very small and tortuous and sometimes large reservoirs are connected by very small communications and time must be allowed for the solution to filter through these small openings. To fulfill these conditions, the syringe nozzle must fit tightly over the external opening of the sinus. If there is more than one opening they may be closed by holding a little ball of tightly-wadded cotton over them and the opening that is being injected may be closed in the same way if it is necessary to refill the syringe. I inject steadily until pain is complained of, then I hold the plunger steadily at that pressure for a minute or two, until the patient usually says it has ceased to hurt. I then inject more until the patient again is uncomfortable, and keep on in this way until there is no relief of discomfort while the pressure on the plunger remains the same. I hold this pressure for a minute or two to be sure that the sinus is completely full and then take the picture.

Any syringe will do for this injection if it will stand an internal pressure of two or three pounds and if it has a nozzle that will fit the opening. I ordinarily use a common Luer type glass syringe for this purpose.

[The continuation of this symposium on tuberculosis from the Fitzsimons General Hospital will be found under the Department of Surgery, where, starting on page 223 of the present volume, Captain Harold B. Raycroft's paper on "Phrenic Nerve Operations and Chest Surgery in its Treatment of Pulmonary Tuberculosis" completes its series of five papers —EDITOR.]

Diagnosis and Treatment

THE HOME TREATMENT OF DIABETES

By SEALE HARRIS, M D

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It is estimated that one person in every hundred of population in the United States has diabetes, and probably 95 per cent of diabetics are treated at home by general practitioners. Therefore their diets must be prepared by mothers and housekeepers, many of whom cannot, or will not, learn how to weigh and measure food in grams and calories. Knowing the need for simplified methods of treating diabetes, it has been a pleasant task to endeavor to construct a series of diets, expressed in household terms, which approximate the nutritional needs and the carbohydrate limitations of the average case of diabetes, and it will be most gratifying if these efforts prove helpful to the general practitioner and his diabetic patients.

Since 1924 we have found from experience that it is practicable in beginning the treatment of the uncomplicated cases of diabetes in adults to use one diet with which to test the patient's carbohydrate tolerance. This diet may be added to, or subtracted from, until daily menus have been worked out which will provide sufficient food for the diabetic to eat to satiety, maintain his normal weight, and carry on with ease and efficiency the duties of his vocation.

Of course it is best to treat diabetes scientifically, but since that is not always possible, we have followed the rule which was learned during ten years of general practice, *i e.*, that where the physician cannot do what is best for his patient, then do the next best thing, and above all things, apply common sense in the management of disease. If the diabetic has to be treated at home, even if he is intelligent enough to learn food values, in beginning his treatment it is usually best not to confuse him by discussing grams and calories but to prescribe a diet selected largely from food that is prepared for the rest of the family.

It is important in the very beginning of treatment upon the patient that it is not difficult to prepare

diabetic, nor is it a hardship to live on such a diet, because he can have plenty to eat of a variety of foods, and if he will adhere to his diet diabetes will not shorten his life or interfere with his usefulness or happiness. The fact is that the careful diabetic will live longer than other members of his family who have not been taught to live on a low carbohydrate, well-balanced diet.

Some of the most brilliant results that we have seen in the treatment of diabetes have been among very poor patients who could scarcely read, or write, but who possessed what many educated people lack, *i e*, common sense, and the will to do right. They were placed on diets, containing given quantities of simple foods expressed in household terms, which they carried out in their homes. They were not confused with trying to work with the metric system, and they were not given the fancy, patented diabetic foods that are expensive and often misleading in their carbohydrate content. They were taught simple and practical methods of how to live at home and have diabetes.

CO-OPERATION OF PATIENT NECESSARY

If the diabetic is among the 30 or 40 per cent who will have to use insulin, he should be taught that it is even more necessary for him to adhere to his diet than if he had a mild case of diabetes. Above all things the diabetic should be made to realize the seriousness of his disease, and be impressed with the fact that if he is not willing to follow the diet prescribed by his physician, and remain under his care, even after he has learned the arithmetic and chemistry of diabetes, he surely will suffer the consequences of his dietetic sins. The paths of the careless, self-satisfied and self-indulgent diabetics, who sometimes think they know more than their physicians, like the paths of glory, "lead but to the grave." In order to secure the full co-operation of the diabetic while keeping him under observation until his optimal diet can be worked out, it is necessary to explain to him that the only method of finding out the amount of food he can take and keep his urine sugar free is by trying out a test diet, increasing or decreasing the food, and using insulin if necessary, until the diet suited to his particular nutritional needs has been determined.

TRIAL DIET

If the adult diabetic has no diacetic acid in his urine, if he can take solid food, and if there are no complications he is given the

following trial diet, which may be increased or decreased until a diet is worked out on which he may live comfortably and keep his urine sugar free

Breakfast

- 1 raw fruit, $\frac{1}{2}$ small grapefruit, $\frac{1}{2}$ small orange, or medium sized peach, or $\frac{1}{4}$ small cantaloupe
- 8 tablespoonfuls cream
- 2 eggs, cooked any way except fried, 1 pat butter on eggs while hot
- 3 slices bacon (crisp)
- 1 Diabetic bran biscuit *
- 1 pat butter

Dinner

- 1 cup broth, bouillon, clear or strained vegetable soup
- 1 Uneeda biscuit (cracker)
- Medium serving of lean meat, $1\frac{1}{2} \times 3 \times 4$ in (trim off fat), steak or roast beef, or ham, or roast pork, or fish, or $\frac{1}{2}$ small, or $\frac{1}{4}$ large chicken, or 1 quail, or $\frac{1}{4}$ rabbit, or $\frac{1}{4}$ squirrel
- Three rounded tablespoonfuls cooked vegetables, turnip greens, or collard greens, or string beans, or asparagus, or okra, or cauliflower, or cabbage, or spinach, or 2 tablespoonfuls squash, or beets, or carrots, or onions, or turnip roots
- 1 pat butter on vegetables while hot
- 1 Diabetic bran biscuit *
- 1 pat butter
- Dessert $\frac{1}{2}$ baked apple, or 1 peach (sliced), or 2 tablespoonfuls strawberries, or blackberries, with 4 tablespoonfuls cream
(Cream may be whipped)
No sugar No canned fruits or dried fruits

Supper

- 1 cup soup, strained, as for dinner
- 1 Uneeda biscuit (cracker)
- American or Swiss cheese ($\frac{1}{2} \times 2 \times 3$ in) or 4 tablespoonfuls home made cottage cheese, or meat as for dinner
- 4 tablespoonfuls raw vegetables, celery, lettuce, cold slaw, or 1 large, or 2 small tomatoes, or 1 tablespoonful Waldorf salad
- Diabetic mayonnaise **
- 2 pats butter
- 1 Diabetic bran biscuit *
- Egg and cream custard ***
- Dessert $\frac{1}{2}$ small orange, or $\frac{1}{2}$ small grapefruit, or 1 small or $\frac{1}{2}$ large peach, or $\frac{1}{4}$ small cantaloupe, or small piece (about the size of a small orange) of heart of watermelon

** Recipe for Bran Biscuits*

Use regular feed bran Put 6 or 8 cupfuls in sack and let water run through it, or stir bran until water is clear This usually requires an hour or more Let

this dry, keeping it on hand for biscuits Pillsbury bran may be used without washing

Mix 2 cupfuls washed bran, or Pillsbury bran, with 1 tablespoonful mineral oil Put 1 tablespoonful of agar agar in 1 cup of water, heat to boiling point Mix bran and dry ingredients with agar in water Make biscuits about 1 inch thick Grease muffin tins with mineral oil Cook in moderately hot oven about 40 minutes

**** Recipe for Diabetic Mayonnaise**

1 egg yolk, 1 tablespoonful lemon juice, $\frac{1}{2}$ cupful mineral oil

Place egg yolk and oil on ice Beat yolks and add oil drop by drop stirring constantly This makes five servings of dressing

***** Recipe for Egg and Cream Custard**

1 egg and 3 or 4 tablespoonfuls cream Beat eggs thoroughly, add cream and mix well Pour in container and bake in a slow oven

FIRST RAISE IN DIET

The diabetic is kept on the trial diet for three days and if his urine becomes sugar free he is given a raise in the above diet as follows

Add to breakfast two teaspoonfuls oatmeal, two ounces (4 tablespoonfuls) cream

Add to dinner three tablespoonfuls cooked green vegetables

Add to supper one tablespoonful raw vegetables and one pat butter

SECOND RAISE

If the diabetic continues sugar free for three more days on the trial diet plus the first raise, he is given the second raise as follows

Add to breakfast two tablespoonfuls oatmeal, after cooking

Add to dinner two oz (four tablespoonfuls) cream, and one pat butter

THIRD RAISE

If the patient's urine continues sugar free after the two raises plus the trial diet he is given a third raise of one or two extra slices of bacon for breakfast, and an increase in the quantity of cooked green vegetables for dinner by one or two tablespoonfuls Likewise the amount of meat, fish or fowl may be increased by one-fourth or one-half for dinner or supper

If the patient's urine remains sugar free on the trial diet, plus two or three raises, he will be getting about the optimal diet for the average adult, and he is then kept on that diet indefinitely until there are indications for increasing or decreasing his food

BREAD THE DIABETIC'S STAFF OF DEATH

In some of the milder cases one or two crackers may be added to each meal, or a thin slice of bread, or a small corn meal muffin, or a small piece of corn bread, or a small biscuit. Except in the very mild cases it is better to confine the bread to bran biscuits, or bran muffins, and crackers, because of the old adage, "Give a man an inch and he will take a mile" applies to diabetics who suffer from "bread hunger." Diabetics usually are excessive bread eaters until they have been placed on a diet. They soon learn that they do not need bread, but if allowed bread they get back into their old habit of making bread their principal article of food.

One of the difficult problems with diabetics is to convince them that they not only can live, but that they must live without bread, which they believe to be the "staff of life." Paraphrasing an old aphorism, "what is one man's bread is another man's poison," makes good "food for thought" for the diabetic, because he can poison himself very easily by eating more bread than he can metabolize.

The diabetic's meat must be restricted. It should be explained to him that 58 per cent of meat is turned into sugar and metabolized as such in the body, and if he eats a large amount of meat his urine will soon be loaded with sugar. We have had many diabetics who had been living largely on meats and who were growing worse rapidly because they thought they could eat unlimited quantities of beef, pork, fish or fowl.

While cream and butter should play a large part in the diabetic's diet, whole milk or buttermilk should be used cautiously, if at all, because it must be remembered that about 5 per cent of milk is milk sugar. We have many diabetics who have tried the "buttermilk treatment," sometimes with disastrous results. It is true that an occasional mild diabetic will clear his urine of sugar by drinking three glasses of buttermilk a day, but that is a starvation diet if long continued, but when the diabetic drinks all the buttermilk he wants the sugar returns in his urine. Diabetic children, however, need

milk, and enough to nourish them properly should be prescribed, even if insulin has to be used to metabolize the carbohydrate content of the milk.

THE DIABETIC'S INSANE DESIRE FOR SWEETS

Diabetics also must learn to forget the sweet taste, and for that reason, we agree with Joslin that it is best not to give them saccharin.

One of our diabetics, a lovely woman of fifty years of age, had no control over her appetite and was caught stealing food from other patients' trays. She defined diabetes as "an insane desire for food." Though every possible appeal was made to her to give up sweets, including the effort to frighten her by telling her of the certain death that would come to her if she persisted in her folly when she could get it, she would sometimes eat a pound of candy at a time.

We sent this patient home because we could not control her. We next heard of her being treated (?) by a chiropractor, who advertised in the newspapers that he could "cure diabetes without dieting the patient." It is needless to add that in a few weeks she "dug her grave with her sweet tooth."

The opinion that diabetics may eat honey seems to be wide-spread among laymen, and we have had many diabetics who had been satisfying their longing for sweets by eating honey. It is true that honey is more wholesome for the normal person than white sugar, but honey is just as bad for the diabetic as any other form of sweet.

Coffee and tea should be eliminated from the diabetic's diet for several reasons, the most important being that they contain a habit-forming drug, caffeine, which is a diuretic and the diabetic's kidneys do not need a stimulant. Besides there are few diabetics who will not sip one or two teaspoonfuls of sugar in their coffee or tea.

REDUCING THE FAT DIABETIC

If the diabetic is overweight and does not lose on the trial diet, the cream and butter should be reduced, or cut out altogether, until he is losing from two to four pounds per week. He is kept on this diet until he has been reduced to about ten pounds below his normal weight, and then the cream and butter are added until the diet is

found upon which the patient can¹ hold his weight to about ten pounds below his standard weight

THE UNDERWEIGHT DIABETIC

If the underweight diabetic's urine remains sugar free on the trial diet plus two or three raises and he is not gaining one or two pounds a week, two to four tablespoonfuls of cream and an extra pat of butter are added to each meal until the patient gains up to within ten pounds of his normal weight

Of course the urine of the patient on a high fat diet is watched for the presence of diacetic acid and if that occurs the cream and butter are reduced, or the patient is given a slice of bread and enough insulin to keep his urine sugar free. It should be remembered that "fats burn in the fire of the carbohydrates" and sufficient starches, or fruit sugars are necessary for the complete metabolism of fats

WEIGHING FOOD IN GRAMS

The trial diet and the raises when measured in tablespoons and ounces allow a considerable percentage of error, but since most of the foods used in these diets belong to the 3 per cent, 5 per cent and 10 per cent vegetables and fruits, unless the error is very large it will make little difference in the total carbohydrate content of the three daily meals

It should be understood by the physician and his diabetic patient that the household measurements are not to be compared in accuracy with weighing and measuring food in grams, and the trial diet with quantities prescribed in tablespoonfuls is not to be used except for a few days, with patients who can learn the metric system. The trial diets and the raises were prepared for use by diabetics who cannot buy the gram scales, or who have not sufficient education to learn to weigh and measure their food in grams. We have found it practicable to teach even the most unlearned diabetics to weigh their food in grams, with diets that have been worked out for them

The effort to teach food values to many diabetics only confuses them. In such cases nothing is said to them about carbohydrates, proteins and fats, and the word calorie is never mentioned to them. They are persuaded to spend ten dollars for a Chatillon, or Hanson gram scales, on which with movable dial, they soon learn to weigh

their food The trial diet with raises worked out in grams is given them, and with very little instruction they learn to weigh out their three daily meals Indeed it often is best to show the intelligent diabetic how to weigh his food in grams before the effort is made to teach him the metric system, and the carbohydrate, protein and fat percentages, and caloric values of various foods The following trial diet worked out in grams is useful in such cases.

Breakfast

1 raw fruit 150 gms ($\frac{1}{2}$ small) grapefruit, 75 gms ($\frac{1}{2}$ small) orange,
75 gms peach (without seed), 75 gms cantaloupe or muskmelon (edible
portion)
60 gms (4 tablespoonfuls or 2 ounces) cream
2 eggs
15 gms bacon
20 gms butter ($\frac{1}{2}$ on eggs)
1 diabetic bran biscuit

Dinner

Soup, clear broth, bouillon or strained vegetable soup
1 Unceda biscuit (cracker)
Meat 50 gms lean beef, or steak, or ham, or chicken, or fish, or game
Vegetables 100 gms (after cooking) turnip greens or collard greens, or spinach
or cabbage, or asparagus, or okra, or 50 gms squash, or beets, or string
beans, or carrots, or onions, or turnips
20 gms butter ($\frac{1}{2}$ on vegetables while hot)
1 diabetic bran biscuit
Dessert 50 gms baked apple, or 75 gms peach, or 50 gms pear, or 75 gms
strawberries, or 75 gms blackberries, or 75 gms dewberries, or 50 gms
raspberries, no sugar
No dried fruits or canned fruits or berries
60 gms cream

Supper

Soup 1 cup, strained, as for dinner
1 Unceda biscuit (cracker)
Meat substitute 40 gms American or Swiss cheese, or 50 gms cottage cheese,
or 60 gms English (green) peas, or 60 gms lima or "butter" beans, or, if
meat is preferred, 50 gms as for dinner
Raw vegetable 30 gms lettuce, or 60 gms cold slaw, or 60 gms tomato, or 75
gms celery, or 40 gms Waldorf salad. Diabetic mayonnaise If raw vege-
tables not available may use cooked vegetables as for dinner
20 gms butter
1 diabetic bran biscuit
Dessert Diabetic egg and cream custard, or 150 gms ($\frac{1}{2}$ small) grapefruit,
or 75 gms orange, or 75 gms peach, or 75 gms cantaloupe, or 75 100 gms
watermelon (edible portion)

FIRST RAISE IN GRAMS

If the diabetic's urine is sugar free after one, two or three days, on the trial diet weighed in grams, the first raise is made as follows

Add to breakfast forty grams of oatmeal (after cooking) For dinner add fifty grams of green vegetables, making 150 grams of vegetables

SECOND RAISE

If the diabetic's urine remains sugar free or becomes so in one, two or three days on the trial diet plus the first raise, make the second raise consisting of forty grams more of cooked oatmeal, making eighty grams of oatmeal for breakfast

Also add sixty grams cream, making 120 grams cream (four ounces), for breakfast

Sixty grams cream and ten grams butter may be added to dinner

THIRD RAISE

If the diabetic's urine is sugar free, in one, two, or three days after the first two raises ten grams (two slices) of bacon are added to breakfast making twenty-five grams bacon for breakfast, and fifty grams more of green vegetables are added to dinner or supper Likewise the amount of meat, fish or fowl may be increased by twenty-five to fifty grams

DIETING THE DIABETIC CHILD

The problem of dieting the diabetic child differs from that of the adult diabetic because of the fact that the child must have milk and other liquids, or semi-solid foods Of course the actual quantity is less, though pound for pound the child needs relatively more food than the adult

It is difficult, or impossible, to construct a trial diet that would apply to the infant and the ten-year old child but we have prepared a diet, which about meets the nutritional needs of a three- or four-year old diabetic. It may be reduced for a younger child or added to if the child is older

Breakfast

60 grams (4 tablespoonfuls or 2 ounces) milk
 30 grams (2 tablespoonfuls or 1 ounce) cream
 1 egg
 15 grams butter, 1½ pat on egg
 30 grams (2 tablespoonfuls or 1 ounce) orange juice in water or
 ¼ scraped apple
 1 cup broth or soup, clear

Dinner

1 cup soup, chicken broth, bouillon or strained vegetable soup
 60 grams (4 tablespoonfuls or 2 ounces) milk
 30 grams minced chicken or scraped beef (1 tablespoonful)
 30 grams (2 tablespoonfuls or 1 ounce) cream
 15 grams butter, 1½ pat
 60 grams (2 tablespoonfuls) 3 per cent vegetables, okra, spinach, celery, to
 matoes or 1 tablespoonful peas

3 00 P M

30 grams (2 tablespoonfuls or 1 ounce) orange juice in water, or
 ¼ scraped apple
 1 cup broth or soup

Supper

Soup or broth

Custard

½ egg

½ oz cream

½ oz. milk

30 grams (2 tablespoonfuls or 1 ounce) cream

60 grams (4 tablespoonfuls or 2 ounces) buttermilk

10 grams butter, 1 pat

Suggestions for Raising Diet of Diabetic Child

First Raise—usually after 3 to 5 days

To breakfast add

1 oz milk

1 oz cream

½ pat butter, 5 grams

Second Raise—usually 8 to 10 days after treatment has been begun

To dinner add

Same as first raise

Third Raise—12 to 15 days after treatment has been begun

To supper add

Same as first raise

Fourth Raise—Usually bringing patient to optimal diet

To dinner add

30 grams—1 tablespoonful—minced chicken or scraped beef

1 oz. cream

It will be noted that the four raises added to the trial diet are quite enough to increase the weight and vigor of the average child. The child is kept on this diet, either with or without the insulin, so long as it continues to maintain the proper rate of growth. The diet is then further increased.

The dieting of the diabetic child is difficult and dangerous. The earlier the mother learns how to diet her child and use insulin, if necessary, the more hope she has of saving her child. John, of the Cleveland Clinic, expresses the conviction of every clinician who has had a large experience in treating diabetic children, when in his *Diabetic Manual* he says

"The essential features of the treatment of diabetes in children are hospitalization, diet, and insulin. No child should ever be treated at home first. The reasons for hospital treatment are these. In a hospital there is a trained dietitian who knows how to calculate, weigh, and plan the meals according to the doctor's directions. The nurses collect a twenty-four-hour specimen of urine each day, which is examined at once in the laboratory of the hospital, so that the doctor may know just how much sugar the child is losing. Specimens of blood are taken from time to time, and estimations of blood sugar are made to see whether or not the treatment is enabling the child to maintain a normal blood-sugar level. The doctor is thus enabled to plan the treatment intelligently according to the indication in each case, that is, he finds out just what food each child should have and how much insulin, if any, is required each day to control the diabetic condition. After all these points have been determined—usually in from four to six weeks—the doctor can say with certainty to the mother, 'You may take your child home with safety, provided you will continue to give him the diet which we have found to be the best for him, and provided you give him each day the amount of insulin which we have found he needs.'

"The mother then becomes responsible. The child's very life is in her hands from the moment that she takes him away from the hospital, for unless she carefully and exactly follows the doctor's instructions, the child is lost, therefore the mother must learn how to calculate and weigh the diet, and how to administer the insulin. These details may seem troublesome and difficult at first, but the routine soon becomes a habit, and like all other habits it is carried

out almost automatically. From time to time the child must be brought back to the physician for an examination of the urine and of the blood in order that the diet and the dosage of insulin may, if necessary, be readjusted. Just as one must sooner or later readjust a motor even though it has been adjusted properly by a mechanic, so one must also readjust the general treatment of a diabetic child. Many things can happen which may alter the condition, such as a cold or other infection, an inadvertent error in diet, etc., and after each such mishap one must again find out what may be the new requirements, or as time goes on the condition of the child may improve to such an extent as to warrant an increase in the diet and a decrease in the dosage of insulin. The important and vital point to bear in mind is that all such changes should be made by the physician, who, in turn, depends upon what he finds in his examination of the urine and of the blood."

No doubt the diabetic child stands the best chance to live by his mother's taking him to a hospital that has a diabetic department and she must understand that in going to such an institution she will be in a school to learn how to make her home a safe place for her child to live. It is true that often the family has not the money to send the mother and child to a hospital, but there is not a clinician in the world who would not willingly give his services to an indigent diabetic, provided the family or community can get up the money to pay ward rates in the hospital and buy gram scales, an insulin outfit, and reagents for examining urine. Still it is possible to treat diabetic children at home if the physician can give the patient and the mother a great deal of time.

Most diabetic children require insulin, and greater care must be observed in working out the insulin doses of children than of adults. It may be stated however that there is no danger to the youngest infant in giving insulin provided the dosage and the diet have been properly adjusted.

INSTRUCTION FOR THE EDUCATED, INTELLIGENT DIABETIC

If the patient can buy the gram scales and is sufficiently intelligent to apply the metric system in weighing and measuring his food, he may be treated at home, provided his physician has had the opportunity of learning diabetic arithmetic and that he under-

stands fully how to adjust the insulin dosage. The diabetic manuals by Joslin, John, and Duffie may be used with advantage in teaching the intelligent diabetic how to live at home.

The greatest joy that can come to a clinician who treats diabetes is to deal with an intelligent diabetic who can learn the simple principles of nutrition, and who possesses the self control required to live within his carbohydrate limitations. The clinician can promise such a person that he can control his diabetes as certainly as two and two make four. Indeed in no other disease within the whole realm of medicine has the treatment been placed on such an accurate basis. In treating diabetes the physician must become the serious interested instructor who can take the time to teach the diabetic the general principles of nutrition, with particular reference to making menus containing the amounts of carbohydrates, proteins and fats needed in his particular case. Nevertheless the diabetic should be made to understand that while he can learn to diet himself, use insulin and examine his urine for sugar and diacetic acid, he is not qualified to treat himself or any one else with diabetes. The old French aphorism, *re*, "the doctor who treats himself has a fool for a doctor and a fool for a patient," is particularly applicable to the diabetic who thinks that he can dispense with the services of his physician. He has the "little knowledge that is a dangerous thing," and he should understand that while he is not sick in bed, he needs the care of a physician to keep him well, and he should report to his physician as often as may be necessary to prevent the complications of diabetes.

EXAMINING THE URINE AT HOME

One of the first lessons that the diabetic should learn, whether he is treated at home or in a hospital, is to examine his own urine for sugar and diacetic acid. One or two test tubes, a few ounces of Benedict's solution, a small bottle of ferric chloride, and a medicine dropper will not cost the patient over a dollar, and that is all he needs to keep informed as to whether or not he is eating too much glucose-forming food and also as to whether or not he is metabolizing his fats.

To test the urine for sugar add eight drops of urine to a teaspoonful and a half of Benedict's solution in a test tube, shake "

place it in a cupful of boiling water on the kitchen stove, and let it simmer for five minutes. If a heavy greenish precipitate forms it means a trace of sugar, if a yellowish sediment is found a moderate amount of sugar is present, and if the precipitate is red it shows that the urine is heavy with sugar.

For several weeks after beginning the treatment the patient or some member of his family should examine two or three specimens a day until he learns the diet he can follow and keep his urine sugar free, and he should examine his urine frequently as long as he lives. If the diabetic is tempted to eat sweets, or too much bread or other starchy foods, or if he eats too much meat, then when he examines his urine and finds it loaded with sugar, he will not be so apt to repeat his indiscretion in eating.

The test for diacetic acid is just as simple. To about two teaspoonfuls of fresh urine add six or eight drops of liquor ferri chloridi, U S P. If the urine turns reddish a small amount of diacetic acid is present, but if it turns a deep Burgundy red, it shows a tendency to acidosis, an indication for the diabetic to reduce his fats or cut them out altogether, until there is no diacetic acid in his urine. It is better, however, to teach the diabetic to send for, or report to, his doctor when he finds the heavy red color on adding the iron to his urine. The diabetic should know that if he takes aspirin the ferric chloride test for diacetic acid will be positive.

WHEN AND HOW TO USE INSULIN

If after three days on the trial diet there is still sugar in the diabetic's urine, he is given from three to five units of insulin twenty minutes before eating two or three times a day, and if in twenty-four hours his urine still contains sugar he is given from six to ten units of insulin three times a day. If in another twenty-four hours the sugar has not disappeared from the urine, fifteen units are given three times a day. In the severe cases twenty, or even twenty-five or more units may have to be given three times a day before the patient's urine becomes sugar free, but in the majority of cases five or ten units two or three times a day will be sufficient. When the patient's urine becomes sugar free on this diet from the use of insulin, if necessary to gain weight or to maintain bodily strength and vigor the diet is raised as above outlined and if the

sugar returns in the urine the insulin dosage is increased until the urine is free from sugar. Then the second raise may be made, and if the sugar reappears in the urine the insulin is increased by three to five units before each meal, each day until his urine becomes sugar free.

The third and fourth raises may be made in the same way, increasing the insulin slowly until the urine is sugar free. After the patient's maintenance diet and his insulin dosage have been worked out as above described he is kept on it, with the same dose of insulin for several weeks, the effort being to keep the urine sugar free, without insulin reactions. If the insulin reactions occur, the insulin is reduced or the food increased.

DISCONTINUING THE INSULIN

In many cases of diabetes after a few weeks' rest to the pancreas by dieting and by the use of insulin, the patient's carbohydrate tolerance is increased. In such cases the insulin dose is gradually decreased and if the sugar does not reappear in the urine the insulin may be discontinued permanently. When the insulin is discontinued the patient should be made to realize that he should never overeat, that a food debauch may break his carbohydrate tolerance and he will then have to use insulin again.

From the above statement of facts the idea that once a person begins the use of insulin it is dangerous or harmful to leave it off is proved to be erroneous. It is true that the severe diabetic may have to continue insulin for the rest of his life, but without insulin he could not live long. With insulin and the proper diet there is no reason for diabetes to interfere with the health, or efficiency, of the most severe cases of diabetes. Insulin is therefore a great boon to diabetics and thousands are living today who would have been dead without it.

Insulin is not habit forming, but it should not be left off suddenly without at the same time reducing the diet in proportion to the amount of insulin used. The patient taking insulin should keep on hand an adequate supply, but if he cannot get insulin he should reduce his food by one-half, or even two-thirds, and leave off the fats altogether, because the principal danger from leaving off insulin suddenly is acidosis, or even coma. It is not lea,

that is harmful, but continuing the extra food that he could metabolize by using it.

We have had a number of diabetics whose carbohydrate tolerance was increased to such a degree that they did not need the insulin, but they insisted upon continuing it because they said they felt better while using it. This observation has been made by others, which leads us to believe that insulin may have other physiological properties besides its effect on carbohydrate metabolism.

The patient using insulin should be made to understand that if for any reason his food is cut down his insulin dose should be reduced in proportion. If he fasts a day he must use no insulin without explicit directions from his physician, and if diarrhoea develops the dose of insulin should be reduced because food may pass through the intestines without digestion and the diabetic with diarrhoea may have a low blood sugar, which, with the addition of insulin, may be reduced to a dangerously low level. A number of clinicians have reported hypoglycemic reactions from the use of even small doses of insulin with diabetics who have diarrhoea.

THE TIME OF ADMINISTRATION

There is a difference of opinion as to the best time for the administration of insulin. We believe, however, that the method employed in the Toronto Clinic of using insulin two or three times a day, 20 minutes before the morning and evening meal, has many advantages. In the severe cases insulin may be given before each of the three meals and if the patient is sick enough to require a night nurse, the midnight dose may be added. In the case of laborers, Woodyatt and Wilder advise giving only one dose a day and that before breakfast. In such cases most of the carbohydrates for the day are given for breakfast.

THE METHOD OF ADMINISTRATION

It may be stated, without fear of contradiction, that no pancreatic extract or other preparation said to contain insulin is of any value whatever when administered by mouth. The only method of administering insulin that will give any results is hypodermatically. It is best given under the skin, and not intramuscularly. When ad-

unmannered intramuscularly insulin causes pain because it has a slightly destructive and irritant effect upon muscular tissue

The subcutaneous spaces in the outer surface of the arm, two or three inches below the shoulder, and over the breast and abdominal muscles are favorable sites for the use of insulin because it can be used there without causing tension of the skin. The needle should not be used at the same place twice in succession because it may produce scar tissue and when that occurs the insulin, if absorbed at all, will be absorbed very slightly.

The fine platinum, or gold, hypodermic needle which can be sharpened every few days on a fine stone, and which can be flamed, is less painful than the ordinary needle and its use saves the time necessary for boiling the steel needles. The initial cost of the platinum, or gold, needle is more, but since it will not rust, it is economical in the long run. Strict asepsis should be taught to, and practiced by, the diabetic using insulin because even a slight infection may change a mild case of diabetes into a severe one.

THE INSULIN REACTION

For a time it was feared that the reaction from an overdose of insulin might result in lowering the blood sugar to the lethal limit of 0.04, but with experience there is no longer fear of the insulin reaction with the size doses now ordinarily used. Unfortunately someone called the hypoglycemic reaction "insulin shock," which has had the effect of unduly stressing the dangers of an overdose of insulin. Indeed, it is desirable for patients using insulin to have an occasional reaction, the symptoms of which are hunger, weakness, nervousness and sometimes profuse perspiration. We have had many insulin reactions with our patients, who are relieved in a very few minutes by taking three ounces (one-half glass) of orange juice, or a teaspoonful of sugar. A glass of milk will also relieve the symptoms of the insulin reaction.

While the insulin reaction is usually harmless, it is within the range of possibility that a severe reaction could occur in which the symptoms would be collapse and unconsciousness. Children with severe insulin reaction may become unconscious or have convulsions, but with the size doses that are used these symptoms are not likely to occur. In other words, there is no more danger of a serious reaction

from the use of insulin than there is from an overdose of thyroid extract. If a serious reaction should occur the best treatment is to give adrenalin 0.5 to 1 cubic centimetre hypodermatically, which will restore consciousness in a few minutes by mobilizing the glycogen in the liver. The effect of adrenalin, however, is evanescent and the patient should at the same time, or as soon as consciousness returns, be given orange juice or glucose by mouth. Glucose may be given intravenously if the patient is unconscious.

I know of a case of nephritis in which a mistaken diagnosis had been made of diabetic coma in which the physician gave the patient, who had had no nourishment in hours, 100 units of insulin. The patient was unconscious at the time the insulin was given, but three days after was living, so the 100 units had done no harm. We have given as high as 250 units in twelve hours to a patient in coma, but at the same time 400 grams of glucose were given to cover the insulin. If there is any fear of insulin reaction, orange juice or glucose may be given at the same time the insulin is given. An unlimited amount of insulin can be given provided enough soluble carbohydrate is given to be metabolized when the patient has the extra insulin in his blood.

INCREASED DOSES IN INFECTION

There are no fixed doses of insulin for any groups or classes of diabetics. The dose for each patient must be worked out according to his proved glucose tolerance, and the dose may vary with an individual diabetic, sometimes without any discernible cause. The dose of insulin must be increased with the occurrence of infections because they lower sugar tolerance and tend to the production of ketone bodies. This is particularly true of the lung infections in diabetics, in whom coma was the frequent *modus mortui* up to the time of insulin. Now the diabetic with pneumonia can be carried through the crisis by giving large doses of insulin, fifty to 100 units a day, the dose depending upon the amount of sugar and diacetic acid in the urine. At the same time each day two quarts of a five per cent solution or one quart of a ten per cent solution of glucose should be given either by mouth, or intravenously to the diabetic with pneumonia. Even a slight cold may result in pneumonia and thus precipitate coma. The diabetic with coryza or bronchitis there-

fore should be put to bed and several specimens of urine examined a day. If the amount of sugar is increased and diacetic acid appears in the urine, the dose of insulin must be increased and the fats in the diet decreased. Often it is necessary to cut out the fats entirely and increase the carbohydrates until the diacetic acid disappears from the urine.

MANAGEMENT OF THE SURGICAL DIABETIC

Before the discovery of insulin, operations upon diabetics were followed by a high mortality. Now operations upon diabetics who have been prepared by the proper diet and the use of insulin are as safe as upon any other class of individuals. Except in a very few severe diabetics who occasionally seem to be totally depancreatized, the blood sugar can be reduced to normal and ketone bodies can be removed from the blood in a very few days. Gas-oxygen and spinal anaesthesia are the preferable anaesthetics because ether tends, at least temporarily, to lower glucose tolerance. Chloroform should never be used upon the senile diabetic because arteriosclerosis is frequently associated with diabetes and no one can tell the state of a heart muscle in an old diabetic. Local or spinal anaesthesia is preferable to a general anaesthetic, particularly in the surgery of the extremities. Even major operations upon the diabetic, as those of the abdominal cavity, may often be performed under spinal or local anaesthesia.

Following operations of any kind upon the diabetic the urine should be examined for sugar and diacetic acid every three or four hours. If there is no diacetic acid in the urine and the patient can take no nourishment, it is best not to give insulin the first twenty-four hours after operation, but if there is diacetic acid in his urine the insulin should be given and glucose given, intravenously if necessary, two grams to each unit of insulin. If there is a tendency to acidosis, thirty or forty units of insulin may be given three or four times a day, or every three hours in severe cases, but at the same time sixty or eighty grams of glucose should be given to prevent a hypoglycemic reaction and to aid in metabolizing the fatty acids in the tissues. If there is only a small amount of diacetic acid in the urine, ten or fifteen units may be given three times a day, giving at the same time twenty or thirty grams of glucose either by mouth

or intravenously. If the patient can retain it, orange juice may be given instead of glucose. One glassful, six ounces, of orange juice contains about twenty grams of carbohydrate.

If glucose has to be given intravenously it is best to use the ampules prepared by reliable pharmaceutical houses. It is important for the glucose solution to be sterile, but it should never be boiled, because boiling cooks sugar and forms a caramel-like substance, which in the blood may cause death. If the sterile solution has to be made fresh, boil the water and take off the stove, then add the glucose to make a five per cent solution, place in sterile bottles and cool to body temperature by running cold water over the bottles.

An important post-operative procedure with diabetics is to give them plenty of fluids, not less than two litres (quarts) of fluid a day. If the patient is vomiting, it is best to give water by hypodermoclysis. It will not do to depend upon proctoclysis for the administration of fluids and glucose to the diabetic after operations, because absorption from the colon is uncertain and the post-operative diabetic must have fluids and carbohydrates to keep down acidosis.

From the above suggestions regarding the surgery of diabetes the difficulties of caring for such cases at home would seem to be almost insurmountable. The general practitioner, therefore, should advise the diabetic with gangrene or other surgical complications to go to a hospital and place himself under the care of an internist who has had ample experience in treating and dieting such cases. Likewise it is important to select a surgeon who has had a large experience in operating on diabetics. Of course in emergencies the general practitioner may have to operate on the diabetic at home, under which circumstances he will have to do the best he can with the resources at his command.

THE TREATMENT OF COMA AT HOME

The general practitioner should be prepared at all times to treat diabetic coma, because an emergency call at night may be to such a patient, and when such a call comes he should plan to stay with the diabetic day and night until the patient comes out of coma or dies. It is even more important to remain with a coma patient than with an obstetrical case. Sustained vigilance on the part of a physician is often the price to pay for the life of a diabetic in coma.

The physician who is called to a suspected case of diabetic coma should carry in his handbag 200 or 300 units of insulin, several ampules of glucose, a few test tubes, small bottles of the reagents for Benedict's qualitative tests for sugar and for diacetic acid. A spirit lamp and a small bottle of wood alcohol are useful, though the tests for sugar may be made by placing the test tubes containing the reagents and urine in a tin cup of boiling water on a kitchen stove and keeping them there for five minutes.

The first thing to do in suspected diabetic coma is to examine a specimen of urine for sugar and diacetic acid. If both are present in large quantities, one need not wait to make the quantitative tests or for a blood sugar determination before giving fifteen to thirty units of insulin and at the same time give a glassful of orange juice. The glucose may be added to the orange juice, though it is important to keep an accurate account of the amounts given.

The next step is to clear out the colon by enemata, repeating them every hour until there has been a thorough bowel evacuation. An ounce of magnesium sulphate may be given by mouth if the patient can swallow. If food has been taken within three hours before the physician sees the case, the stomach should be emptied by gastric lavage. A quart of water may be left in the stomach after the stomach is empty of food.

Water by mouth, if the patient can swallow, is important, not less than one pint every two hours for an adult patient with a tendency to coma. One should be very sure that the patient can swallow before giving him water by mouth. It is perfectly possible to drown an unconscious patient by giving water, or a glucose solution, in spoonful quantities. If the laryngeal or epiglottidean reflexes have been abolished fluids given by mouth will gravitate into the open larynx. If there is any doubt about the patient's being able to swallow, the glucose should be given intravenously and water, one pint every two hours, may be given by hypodermoclysis.

If the patient cannot void his urine, a catheterized specimen should be obtained every half hour. If in one-half hour the examination of a second specimen of urine shows no change in the amount of sugar and diacetic acid, thirty units of insulin and sixty grams of glucose may be given intravenously, and in an hour this dose may be repeated if there is no change in the amount of diacetic acid.

After the initial dose thirty units of insulin may be given, always guarding it with twice as many grams of glucose or dextrose, every two or three hours until the patient comes out of coma. There is no danger whatever in giving large doses of insulin provided enough glucose is given at the same time. It should be understood that in treating diabetic coma one is not trying to render the urine sugar free. It is the acidosis, manifested by the presence of diacetic acid in the urine that needs to be combated, and in giving glucose or dextrose or other form of carbohydrates to the coma patient it not only prevents insulin shock, but the fatty acids that are killing the patient are "burned in the fire of the carbohydrates."

After the patient comes out of coma the dose of insulin should be reduced and the amount of carbohydrate should be correspondingly diminished. Usually twenty units three times a day are sufficient, and the patient placed on the trial diet, giving no fats until the diacetic acid disappears from the urine. In the fat subject it is sometimes necessary to give more carbohydrate and more insulin because the patient's own fat may be burning enough to produce acidosis. In treating diabetes one should never forget the endogenous sources of food.

After the diacetic acid disappears from the urine the amount of food, including fats, is gradually increased up to the patient's maintenance diet, and enough insulin is given to keep the patient sugar free.

PERSONAL HYGIENE OF THE DIABETIC

The diabetic is just as ignorant as the average person regarding the functions of the various organs and tissues of his body, and since he must take extraordinarily good care of himself for the rest of his life he should be taught personal hygiene, with particular reference to measures to prevent the complications of diabetes. One or more hours may be profitably spent in teaching him the facts that he should know about ventilation, rest, exercise, bathing, the care of his teeth, and intestinal elimination. He should learn that he should never overwork, that long hours or excessive mental or physical fatigue often lowers sugar tolerance.

The physician should get from the diabetic the character of his work, the number of hours a day he is at his place of business and

determine whether or not he is overworked. It happens not infrequently that the patient's urine is sugar free on his optimal diet, while resting in bed, but when he returns to his work the sugar returns. If he is then instructed to have shorter hours and be relieved of some of his work he can carry on and keep his urine sugar free. Acute and chronic fatigue are great foes of the diabetic.

EXERCISE AND REST

The question of exercise for the diabetic is an important one. Usually it is desirable for the diabetic whose urine is sugar free, to take daily moderate systematic exercises, but he should avoid too strenuous or long continued muscular effort. The diabetic should be taught a system of exercises suitable to his particular needs and which he may take in his room by an open window, before his morning bath and perhaps at night before retiring. Included in the exercises are movements of the muscles and joints of the feet and toes with the idea of improving the circulation.

Outdoor exercise, particularly walking, is desirable and should become a part of the daily life of the diabetic. If the diabetic has not been accustomed to exercise he should begin with a walk of a hundred yards and gradually increase the distance each day as his strength increases, until he is walking several miles a day. Golf is an ideal though expensive form of exercise for the diabetic, but the man over sixty should never play more than nine holes in an afternoon or morning.

The diabetic needs more sleep than the average person and should be taught to remain in bed nine hours at night, even if he does not sleep all the time. He should have a siesta of at least half an hour after the noon meal. Five- and ten-minute rest periods every two or three hours during the day are helpful, particularly to mothers and housekeepers.

PREVENTING GANGRENE

The diabetic should have his regular morning full bath and should never fail to bathe his feet before retiring. Indeed he should be more careful about the cleanliness of his feet than of his face. He should put on fresh hose every morning and should have two or three pairs of comfortable shoes so that he can change them each day and

allow the other one or two pairs to dry out before using them again. He should have a good light, and should exercise great care in trimming his toenails and in shaving his corns, because gangrene of the foot often starts from minor injuries on the toes.

The diabetic should be impressed with the necessity of two or three thorough bowel evacuations each day. Obstinate constipation is too frequently associated with acidosis for there not to be a relationship between them. Fortunately the diabetic diet of fruit, five- and ten-per cent. vegetables, bran biscuit and fats will enable many of them to overcome constipation.

The diabetic should keep an accurate record of his daily or semi-weekly weight, and under no conditions should allow himself to become, or remain, overweight. Indeed it is best for him to be about ten pounds under the average weight of an individual of his height and age.

Finally it is important to impress the diabetic with the fact that he has no reason to feel sorry for himself because he has diabetes, but he should rather be grateful to his physician for finding that he has a disease which need not shorten his life and which can be kept under control by the new methods of treatment. The diabetic, however, should feel ashamed of himself if he does not conquer his disease, because most of the ills of the diabetic are a confession of his ignorance or self-indulgence.

ACCIDENTS DURING ELECTROTHERAPY AND LIGHT THERAPY AND THEIR PREVENTION

By RICHARD KOVACS, M D

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ELECTRICAL energy is an obedient and accommodating servant and is invaluable as the prime mover of many functions of modern industry, travel, home life and likewise in the art of healing. But it is a powerful agent which must be used with care and with a knowledge of how to prevent accidental injuries due to its use.

A. ACCIDENTS DURING ELECTROTHERAPY

Considering the widespread application of electricity for therapeutic purposes, there is an almost negligible amount of injury caused by it and this is, of course, due to the safe and efficient forms of apparatus in use and to the ability of physicians and technicians to apply the various currents with a proper technic. Nevertheless, accidents, from time to time are unavoidable. They may be due to physical causes in apparatus or lack of attention, experience or sufficient training of the person administering the treatment, and finally, inattention or misunderstanding on the part of the patient under treatment may be a contributory cause.

The injurious effects of electricity may consist in either local injuries, such as burns and other local injuries, or in general effects, electrical shock.

(1) *Local injuries*—The local injuries which may occur in the therapeutic application of electricity are always caused by an undue amount of current concentration over a small area of the skin or mucous membrane. In the surgical applications of both the galvanic and the high-frequency current we produce such current concentration purposely for the destruction of benign or malignant new growths or other diseased areas, and the destructive effects most of the time are not due to the absolute strength of the current, but rather to the

disproportion of the area of the active and indifferent electrode. A galvanic current of a few milliamperes strength or a diathermy current of two or three hundred milliamperes may cause destruction if concentrated to a small area.

In the course of any ordinary electrical treatment an undesired concentration may occur by accident or by faulty technique and its effects vary from a passing erythema to blistering of the superficial layers of the skin or deep tissue coagulation with subsequent ulcer formation and extensive scarring. The patient's skin normally tends to ward off such undesired effects by registering the sensation of pain and hence the fundamental rule in applying any form of electrical treatment is always to keep within comfortable sensation of the patient. Skin sensation may be disturbed in some patients from pathological or functional changes in the periphery or in the brain, and in such patients burns are apt to occur without the individuals' registering any undue sensation. Ordinarily, however, patients know and tell when they have a feeling of being burned, and constant careful attention during every treatment will obviate these unpleasant effects.

According to the therapeutic form of electricity employed, burns may be caused by either chemical or thermal tissue destruction. The occasional small blisters caused by the static wave current most likely are due to the thermal effect of continued small sparks over an uneven contact. The common features of both types of burns depend on the fact that they are due to devitalization or destruction of tissue, they are slow of healing, may become infected, and according to the depth and the area of destruction, may be followed by extensive, unsightly scarring.


The mechanics, pathology and treatment of therapeutic burns are best presented by grouping them according to their three main varieties.

(a) *Galvanic or electrolytic burns*—Currents of low tension and low frequency, such as the galvanic, interrupted galvanic, or even the slow sinusoidal current, when applied to the skin or mucous membranes cause the formation of caustic and acid chemical products at each of the poles. Covering the bare metal electrodes with wet pads of sufficient thickness induces diffusion and absorption of the ions and so prevents their direct contact with skin or mucous membrane, in this way restricting the desired polarity effects to mild

counterirritation of the surfaces. If the bare metal electrode or any corner of it comes into contact with the skin, or if the pad is too thin or not sufficiently wet, or if there is a break or scratch in the skin, there will be direct chemical action from either the positive or negative pole, that if not detected in time may have destructive effects on the underlying skin. These untoward results vary according to the strength of the current, the duration of flow, and the pressure under the electrode. There may be an erythema lasting several hours, or a slight wheal formation disappearing next day. In case of more pronounced effect, there comes blister formation of varying size and shape. These blisters may be single or confluent and are usually painless. In a day or two appears a red line of inflammation and the blister breaks, leaving an open ulcer. Should several blisters form, a large denuded area of varying depth may develop and this, due to the usual secondary infection, may become quite painful and heal quite slowly.

Treatment of electrolytic burns, once they have unfortunately occurred, is similar to those of any other burns. After antiseptic cleansing the first dressing is made with a boric-acid ointment. If on the next day the burn is found to be more or less dry and the surface of the skin is broken, a dusting powder with dry gauze held by adhesive plaster is all that is needed. When the burn is a large one and ulcerated, the boric acid ointment dressing should be continued. Daily exposure to the rays of an infrared or incandescent lamp for half an hour or more promotes nutrition and speeds up healing.

(b) *Diathermic or heat burns*—In case of undue concentration of current from either the bipolar or monopolar high frequency current, drying or coagulation of tissue may occur, such as is produced intentionally by electrodesiccation or coagulation. According to the contact surface between the active electrode and the skin and the strength and duration of the current flow, the effects vary from a whitish discoloration of the epidermis at one or more points to actual formation of blisters and changes to a considerable depth in the color and consistency of the skin. The current flow is fortunately usually cut short as most of these burns are preceded by an intense of pain so that the patient usually cries out for help or s!



electrodes These burns do happen at times almost unnoticed, however, especially in people with defective heat sensation

The later course of diathermy burns is similar to those of other electrolytic origin If only the superficial epithelium has been seared, it peels off in a few days, leaving no trace of a lesion In patients with a marked exudative diathesis a large wheal may appear, immediately or a few hours later, over an overheated area, only to disappear almost entirely by next morning, or leave only a small erythematous area or perhaps a small blister In certain instances, however, there is subsequent sloughing and ulceration, possibly with exposure of subcutaneous tissues, of muscles, even the bone This happens more especially if the treatment was administered by a neophyte who had tightly bandaged a rigid metal electrode over a bony prominence of the elbow or knee, excessive pressure causing both anæmia and anæsthesia, and in the meanwhile keeping up an excessive amount of current while relying on the patient's seeming tolerance Extensive lesions of this sort usually can be attributed to the inexperience and at times carelessness of the operator Too many physicians seem to think that after buying a diathermy apparatus the salesman's advice and some reading up in the literature is all that is needed to apply its currents safely and effectively Fortunately, with the growing opportunities for real clinical instruction and experience, such extreme cases are bound to become much rarer with succeeding years These deep lesions take many weeks for repair, subjecting the patient to considerable suffering and at times here with extensive scar formation and subsequent contractures

Treatment of diathermy burns does not differ materially from that of electrolytic or any other thermal burns Electrotherapeutic applications need not necessarily be discontinued during the healing of a burn unless it is a very extensive and painful one It is usually possible to apply the electrodes at a different angle or position and so to avoid the damaged skin area Usually, if patients realize that the occurrence of a burn was an unavoidable accident, often due to their own contributory neglect, they continue to cooperate gladly

(c) *Static burns*—Static electricity is the form of therapeutic current having the highest voltage, hence its ability to jump a spark gap of often many inches along with an impressive display of sparks and noise This sparking, however, represents only the thinning out

of the electrical fluid under very high pressure, the amperage or volume of current flow being extremely small, less than a milli-ampere. It is claimed, therefore, that it is impossible to cause burns or any other damage by static treatments. This statement cannot be made without qualification, because no matter how low the amperage of the current may be, when limited to a small area and acting long enough, it may cause blisters or tissue destruction just like minute amounts of galvanism when used for surgical purposes. The author has observed small wheals and blisters to form under plates used for static wave treatments and also in some instances where, in administering the static brush discharge, a plate electrode had been placed against the body instead of having the patient hold a shepherd's crook. In these instances the incomplete contact of the electrode resulted in concentration of minute sparks over a small area with subsequent tissue destruction. These static lesions, of course, are of minor import and dry off in a few days without leaving any trace, but their presence causes a needless loss of the patient's confidence. With proper technic they can always be avoided, because patients with normal skin sensation will complain of a burning sensation at some spot under the electrode when not making proper contact. Often simple pressure by a towel over the area complained of at once ends the pain in question, if not, however, the plate is taken off, smoothed off where uneven, and reapplied with uniform pressure.

(2) *General effects of electrical accidents*—*Electrical shock*—Electrical shock is produced by the sudden powerful influence of an electrical current upon the entire body and is characterized by tonic clonic spasm and rigidity of the muscles, including the respiratory muscles during the passage of the current and may be accompanied by fibrillation, paralysis or entire stoppage of heart action. There may be burns at the places of entry and exit. Shock may be caused by any of the forms of low- and high-tension currents used in industry or homes or by lightning. A serious shock can never occur during electrical treatments applied by the recognized technic, but some liability of shock always exists, and a knowledge of the rare conditions under which it may occur and the consequent preventative measures should be familiar to everyone practicing electrotherapy.

During the course of an electrical treatment an electric shock may be caused by one of several contingencies

(a) *Transformer breakdown.*—If a therapeutic current is derived from a high tension transformer and during treatment a breakdown of insulation should happen between the primary and secondary side of the transformer, there is a real danger of the high-tension current jumping over to the patient. Magnetic cut-outs are the only sure preventive of this type of accident as interposed fuses or lamps never act promptly, and before they melt or blow the bulk of the current has passed over them and reached the patient.

(b) *Shock due to leakage or ground current.*—The system of commercial distribution of electricity in metropolitan areas is responsible for infrequent accidents occurring with an apparatus which applies the commercial lighting current directly interposing only a variable resistance. The so-called three-phase system of electrical circuits consists of a network of three separate wire cables, forming a double circuit. One wire is positive, the other negative, and the third neutral, all being insulated from each other and the neutral wire, grounded. The positive and neutral wires furnish an electromotive force of 110 volts, and the negative and neutral also furnish 110 volts, while the entire circuit gives 220 volts. This permanently grounded neutral wire offers liability for the occurrence of leakage or ground currents if a patient under treatment on a 110-volt circuit accidentally touch a grounded pipe, radiator or electric light socket or stand on a wet wooden floor. Such an accidental contact offers direct path to the ground current which, following the line of least resistance, passes directly through the patient to the positive wire, omitting the rheostat. Thus the patient receives the full force of a 110-volt current.

The danger of leakage currents is best avoided by using ground-free apparatus (motor generators) or else by carefully avoiding any grounded object within the reach of the patient or operator. At any rate, shocks caused by such occurrences become serious only if a large surface of the body offers good conduction, as in a person receiving an electric bath.

Rules for safety and comfort of electrical treatments.—(1) Calm and business-like methods of procedure. Most patients are apprehensive when receiving electrical treatments for the first time. A nervous, fidgety operator adds to this uneasiness. One should tell the patient that modern electrical treatments do not hurt and do not

burn, and that there is never more current administered than he can comfortably tolerate

(2) Before the patient is brought near the apparatus, its being in good working order should be ascertained. Make sure that all switches are off or in zero position and that the apparatus is properly connected to the generating source of the activating current

(3) Have the patient get ready for treatment and put him in a position where he is comfortable and will stay so during the entire period, which may require from twenty minutes to half an hour. Patients with lesions of the head, abdomen, pelvis and thigh or entire lower extremity are best put in a recumbent position. Treatment to the shoulder and upper arm should usually be given with the arm propped (as much abducted as possible) up on pillows on a table. That to elbow and forearm should also be administered with the part resting on a table. For the neck or chest, patients may be sitting upright, well propped up in an armchair. For the knee, leg, or foot, an armchair with a foot part which can be raised like the foot-rest on steamer chairs is convenient. In a busy office, privacy should be provided by partitions or by movable screens

(4) Inspect carefully the parts to be treated to make sure that the continuity of the skin is nowhere broken and that the tactile and heat sensations of the patient are normal. Special precautions in this respect are needed in cases of recent scar tissue, peripheral nerve injuries, hysterical anaesthesias. Preliminary exposure of from ten to fifteen minutes to luminous heat is usually advisable as a routine measure to warm up and relax the parts and to decrease skin resistance

(5) Choose the electrodes of proper material and size, moisten and warm them when using wet pads for low-tension currents, and warm them up in case of plain metal plates for diathermy or static treatment. The correct position in which to apply the electrodes—transverse or longitudinal—depends on the condition to be treated. Make sure of good contact all the way through. See that the electrodes *stay* secure in the proper position. It is of advantage, whenever possible, to have one of the electrodes secured by the part resting upon it, while the opposite electrode is held in position by a small sandbag or by a few turns of a woven elastic bandage

(6) Secure the conducting cords to the electrodes and to the bind-

ing posts of the apparatus See that these connections are securely fastened and stay so With a little practice the placing and securing of electrodes and the attachment of conducting cords to them can be performed in one operation

(7) Everything is now ready for the actual starting of treatment Set a time clock or an automatic shut-off switch for the contemplated time Turn on the current by the main switch Tell the patient to report any undue sensation of pricking or heat at once Proceed to turn on the required strength of current by gradually opening the various controls of the apparatus, the rheostat, spark gap, etc Watch the milliammeter for correct working and for the amount of current applied If there is any discrepancy between the patient's tolerance and the amount of current registered on the milliammeter, never try to push up the amount of current without investigating

(8) It is an invariable rule that, in order to allow for proper decrease of skin resistance and not to stir up any sensory or other reflexes in the patient, it should take about five minutes to reach the maximum amount of current. If the patient has any complaint at any time during the treatment, investigate, if necessary, by taking off and inspecting the electrodes In this case, of course, be sure that all the switches on the apparatus are turned to zero before taking off the electrodes Afterwards turn on the current as gradually as on first starting As a rule, never leave the patient alone during any treatment, or at least have an arrangement whereby, if necessary, the patient can instantly shut off the current himself Most modern apparatus are equipped with such pull switches, but one must make sure that the patient knows how to make use of this arrangement

(9) The strength of current to be employed for each patient depends on the size of the active electrode and the condition to be treated Outside of these primary factors, however, the physician must take into consideration the varying temperaments and reactions of patients The sensitive, nervous type usually stands less at the beginning As a general rule, a moderate amount of current applied for a longer period is more effective than pushing up the current to the limit of toleration very quickly There are patients who like to boast of how much current they can tolerate and are not satisfied unless they get the maximum They are like the patient who does not believe that medicine can be active unless it has a nasty, dis-

agreeable taste Others are extremely sensitive and should be started only on a fraction of the indicated dosage

(10) At the termination of treatment, the controls should be turned off gradually in the reverse order to that in which they were turned on. Take off the electrodes only after the current has been turned off entirely Inspect their site carefully Make note of any changes In case of inclement weather do not let patients who have been considerably warmed up during treatment depart immediately from the office Let them rest for ten to fifteen minutes in a rest room or in the anteroom

In addition to these general rules for the application of all electrical treatments, the following special precautions are advisable

(a) *Low tension currents* —Examine to see that the metal plate of the electrode is evenly covered by the padding and that there are no bare edges See that the covering pad is evenly soaked with tap water or saline solution

Apply electrodes in good contact, equidistant and by even pressure Uneven pressure from tight bandaging or from folds or creases in the pad, and insufficiently moistened areas lead to uneven distribution of current and their first subjective manifestation is a burning sensation in one or more spots

(b) *Diathermy* —Before turning on the current from the main inlet, inform the patient that all sensation he or she can expect is that of mild heat Instruct the patient to report at once any uncomfortable faradic sensation, pricking or burning

After starting the current through the main switch, open up gradually, first the current regulator (rheostat) and then the spark gap Only practical experience teaches the proper manipulation of this double control

Do not push the current up to the maximum amount of toleration during the first few treatments Patients often are burned in their endeavor to show how much current they can stand Remember the principle that a moderate amount of heat applied for a longer period is more effective than pushing up to the limit of tolerance for a shorter period

Observance of these simple precautions will greatly help to avoid some embarrassing moments at the beginning of one's peutic practice Accidents resulting in burns or other

occur unavoidably, but as long as the physician has used a technic accepted as standard by those practicing in the same community, he will be relieved from all unreasonable responsibility

B DANGERS OF LIGHT TREATMENT

Although the term *light* in its strictest definition denotes only the electromagnetic waves which specifically stimulate the retina of the eye and give rise to the sensation of light, the general term of *light therapy*, by custom, denotes also the application of the invisible infrared or heat and ultraviolet or actinic rays. Treatment by light, no matter what source it comes from, is capable of producing profound biological effects, and it is only excessive intensity of the source and excessive length of exposure which produce effects destructive to human tissues. In the normal physiological state all living cells are sensitive to infrared and ultraviolet rays, infrared rays in sufficient intensity destroy the cells by coagulation of the protein, ultraviolet rays from, 3,100 A.U. to 2,500 A.U., are absorbed by the cells and cause death by the action on the cytoplasm. In normal physiological state most living cells appear to be insensitive to the visible rays. It has been shown, however, that under certain extraneous influences, as well as by certain changes in the organism, a sensitization to light can come about and in turn produce disease. When applying a treatment from any light source, therefore, it is important to keep in mind not only a dosage which is considered clinically safe in the average patient, but also to watch out for abnormal sensitivity, and this can be determined only by preliminary testing or by very careful observation for early differences from the remedial response.

The dangers caused by light treatment, therefore, can be divided into two groups

- (1) Untoward effects due to overdose or to improper handling of apparatus in persons with normal response

- (2) Untoward effects occurring in persons with hypersensitivity, either inborn or due to pathological conditions predisposing to such sensitivity, and finally in the large group of conditions which are not suited to light treatment at all

Overdose from any light source may result either from an excessive single exposure or from exposures repeated over too long a period. The immediate visible effects of overexposure are an erythema

of varying degree, due to the infrared (heat) rays, exceptionally there may be even immediate blister formation. Ordinarily, however, the erythema disappears in an hour or so and in a few hours the effect of the ultraviolet (actinic) rays begin to show. This consists of a dermatitis—skin burn—of varying intensity and extent. In addition general symptoms may develop, headache, nausea, or even high fever and irregularity of heart action. Several instances of such cases happened when patients fell asleep under an ultraviolet lamp or when they determined to find out how much irradiation they could stand. The severe general effects are due to the flooding of the blood stream with the destroyed protein substances. It is, of course, well known that overdoses of natural sunlight can bring about similar severe reactions. With the present craze for sun tanning, more and more people have overexposed themselves at the seashore or in commercial establishments and there followed an acute painful inflammation of the skin, blisters and a fever up to 104 degrees. Humphris reports a fatal case of a woman forty-eight years old, who took the “sunlight treatment” unknown to her doctor and her husband, and who after the second treatment became ill and developed two burns of brick-red color on the left leg and the lower back. A few days later she developed fever, diarrhoea, hæmatemesis, passed dark blood and died twelve days after her second treatment. At the post-mortem examination gastric and duodenal ulceration was found and the medical men present agreed that these were the result of the burn.

The dangers due to improper handling of apparatus relate principally to the home use of ultraviolet generators. A fatal accident was reported from England a few months ago, where a young man was electrocuted while touching an ultraviolet lamp which he lit in a bathroom. It was found that there were about a half dozen ways in which electrical shortcircuiting could have happened with that particular make of lamp. Placing the quartz burner directly over the patient is dangerous, because if it should suddenly crack or be broken by a careless operator or by unexpected movement of the patient, the volatilized mercury falling on the skin will cause very serious burns. Though rare, accidents of this sort will happen, and I have myself seen a burner thus explode at the Reconstruction Hospital and its fragments and the mercury spatter in all direc-

tions By the order of the Charity Board of Paris it is formally forbidden to place the patient directly under the burner of a mercury arc lamp Humphris criticizes the tendency of manufacturers' advertisements to depict lamps placed directly above a recumbent patient.

The protection of eyes against irradiation must be strongly emphasized, for as a result of its neglect various forms of inflammation have occurred. Painful conjunctivitis of both patients and careless operators have been reported, and recently Lear has described a definite inflammation of not only the conjunctiva but also of the cornea, iris and the lens, called photo-ophthalmia One of his cases occurred in a man who had several "sun-ray" treatments in a Y M C A. gymnasium, with his eyes unprotected

The individual sensitivity of fair people, blondes, young children and old people is well known and if disregarded, may result in skin burns and untoward general effects A congenital error in metabolism, consisting in the presence of a minute quantity of substances allied to hæmatoporphyrin, results in some children and adults so affected after their exposure to bright sunlight in malaise followed by painful skin eruptions causing ulceration and necrosis After ingestion of certain sensitizing substances like eosin, quinine, methyl-blue, a similar temporary sensitization may prevail Only careful routine skin tests, which are possible now by the simple devices recommended, will protect people with special susceptibility against serious untoward results following ordinary doses of general irradiation Extra precaution should be taken with alcoholic subjects, patients under treatment by vaccines and serums, or under medication with arsenic or sulphonal, as they seem too sensitized towards light treatment.

C LEGAL RESPONSIBILITY IN ACCIDENTS

In order to arrive at a clear conception of the liability arising in case of burns and other accidents during the rendering of electrical and light treatments, the Special Committee on Physiotherapy of the Medical Society of the County of New York asked for a legal opinion in this matter, and the reply of Counsel under date of November 21, 1927, is herewith republished.

"You have asked for my opinion as Counsel to the Medical Society of the County of New York upon five questions submitted to me in your letter of November 2, 1927

"Your first question is as follows

"If a burn or other accidental injury occurs in a physiotherapy department of a hospital where treatments are rendered under a physician's direction by nurses or technicians employed by the hospital, who is liable?"

"As I understand the law, neither the hospital, the physician, nor the nurse is absolutely liable for any injury that may occur to a patient. In other words, they are not guarantors against misadventure. An accident, if it be purely an accident and not the result of any neglect or improper act or neglect, does not form the basis of liability.

"Assuming, however, that the inquiry has been occasioned by negligent or improper treatment or neglect, the nurse or technician whose improper act or neglect resulted in the injury is, of course, personally liable. Such liability is, of course, rarely enforced because generally the technician or the nurse is not financially responsible.

"The physician under whose direction treatments are rendered by a nurse or technician is responsible under the doctrine of respondeat superior. The physician is not, however, liable for any injury occasioned by an act of the nurse or technician without the scope of their employment, such, for example, as a wilful attack upon a patient.

"The hospital, if it be an institution organized for profit, would be responsible to the same extent as would be the physician and upon the same principle of respondeat superior. If the hospital, however, is a non profit institution, the hospital is relieved by law from any responsibility.

"Your second question is as follows

"If a burn or other accidental injury occurs in a physiotherapy department of a hospital following a treatment rendered by the physician in charge or any other physician, who is liable?"

"The physician in such a case, always assuming that the injury has resulted from negligent or improper treatment or neglect, is directly responsible.

"Your third question is as follows

"Does the liability insurance taken out under the plan of the County Medical Society protect the physician in the above instances?"

"The group insurance of the Medical Society of the State of New York does protect the physician for his liability with respect to instances set forth in your first two questions. This insurance protects the physician against liability incurred by him anywhere and at any time, so long as he is lawfully practicing his profession.

"Your fourth question is as follows

"If a burn or other accidental injury occurs in a private institution not owned or operated by a physician where treatments are rendered by physiotherapy technicians, can the physician referring the patient there be held liable?"

"The physician should not be liable in such an instance unless he has failed to exercise due care in the choice of the technician to whom he has referred the patient. If the technician is duly licensed under the laws of the State of New York and the physician has no knowledge of his inefficiency, a reference to such a technician should not involve the physician in any liability. The whole matter is really one of the exercise of reasonable precaution by the referring physician

"Your fifth question is as follows

"If a physician sends his nurse or technician to a patient and the patient pays directly to the technician for the service rendered, in case of an accident who is liable?"

"If the physician sends to a patient a nurse or technician in the physician's employ and makes that nurse or technician his own agent or representative in the treatment of the patient, then the physician is responsible for damages occasioned by the negligent or improper acts or omissions of the nurse or technician, other than for wilful acts of the nurse or technician clearly outside the scope of their employment.

"If, on the other hand, the physician suggests to the patient that he knows a technician or a nurse and with the patient's consent undertakes the mechanical details of having the nurse or technician come to the patient's house, thus making the nurse or technician an independent contracting party, the physician is liable only in the event that he has not exercised reasonable care in the selection of the nurse or technician

"I have consulted Robert Oliver, Esq., attorney to the Medical Society of the State of New York, with respect to your questions, and the answers above set forth incorporate both Mr. Oliver's opinion and my own

Very truly yours,

(Signed) REED B. DAWSON,

Counsel, Medical Society of the County of New York."

PLACING PHARMACY UPON A BACCALAUREATE BASIS

By J G BEARD, PH G

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BEGINNING in the fall of 1932 each college holding membership in the American Association of Colleges of Pharmacy will increase the length of its minimum course of study from three to four years. This step is being taken by the colleges in recognition of a need for a broader type of study than is now required of pharmacy students. Several Association colleges are so firmly convinced of the value of the longer course that they have either already adopted it or will do so in 1930. Pharmacy students all over the country are voluntarily transferring from the minimum three-year course now in effect to the optional baccalaureate course in pharmacy that for several years has been offered by leading state and privately endowed institutions. At least two state legislatures, at the instance of board examiners and association officials, have by legal enactment made the four-year course mandatory upon the part of candidates who apply for pharmaceutical licensure in or after 1932. The National Association of Boards of Pharmacy has approved the four-year course. The American Pharmaceutical Association at its recent meeting re-affirmed its endorsement of the plan. Pharmacy students in increasing numbers are, as stated above, voluntarily seeking the broader, longer course. College faculties are rapidly becoming more confirmed in their belief that an additional year should be added to the compulsory curriculum. These evidences point conclusively to the fact that pharmacy itself is convinced that, along with other professions, it must heighten and strengthen its educational standards.

Space limitations do not admit of a discussion here of the many sound reasons that underlie the adoption by the Association of Pharmacy Schools of the minimum four-year course. Suffice it to say that the delegates responsible for this step and the national organizations which have endorsed it were in terms

of future pharmaceutical practice and of the ultimate advantage to pharmacy students than of the immediate educational needs of the present-day practicing pharmacist. In other words, the consideration was not so much a question of what purely technical knowledge a pharmacist must now have in order competently to carry on his dispensing duties and his commercial transactions, but rather of what sort of educational training is best calculated to develop future pharmacists for rôles broad enough to call for their finest response and for a practice that promises more in terms of public benefit.

The step is not revolutionary but evolutionary. First came the two-year course, adopted generally about 1920, then the three-year course, put into effect in 1925, now comes the four-year plan to be effective in 1932. Each extension in course length has justified itself, and there is every reason to believe that the latest extension is not only founded upon sound reasoning but that it is simply anticipating and preparing for professional developments that are looming on the pharmaceutical horizon.

Pharmacy has practically abandoned the apprenticeship system of training. Colleges are now called upon to provide the practical instruction that licensed pharmacists formerly gave to their junior assistants. Modern conditions make almost impossible, except in the small stores, any sort of systematic or efficient practical instruction, so that pharmacy students nowadays must not only receive in college the scientific training they need, but must receive in addition the type of training that was formerly given by preceptors to their apprentices before the latter entered a school of pharmacy. If colleges are properly to teach the scientific subjects that are absolutely essential, are to provide the training in technic formerly given by the preceptor, and are to furnish desirable instruction in certain cultural subjects, they really need all of four years for the task. These and other facts point to the wisdom of the step taken by the American Association of Colleges of Pharmacy and its sixty member schools in placing pharmacy upon a baccalaureate basis beginning in 1932.

In concluding this brief statement it is perhaps well to call attention to the requirements of collegiate education for its entrance into a medical school, of which all now belong to the A Class. In the Educational Number of the *Journal of the American Medical*

Association of August 17, 1929, devoted entirely to the education of physicians and with no mention of pharmacy in the subject index to this issue, it is stated that of the 4,446 medical graduates of 1929 2,951, or 243 more than last year, had also obtained degrees in arts and sciences either prior to entering the medical school or through combined courses, at the end of the first, second, third, fourth or fifth years of the medical course This year 66.4 per cent of all graduates held collegiate degrees, as compared with only 15.3 per cent of the graduates in 1910 As noted in table 10, of the 2,951 graduates holding baccalaureate degrees, 397, the largest number, came from the Illinois medical colleges The New York schools reported 382, Pennsylvania, 294, Massachusetts, 193, and Ohio, 145 All the better medical schools are now requiring two or more years of college work for admission, which brings more students within reach of the combined courses for the B.S. and M.D. degrees "It must not be inferred," says the *Journal*, "from these statements that a baccalaureate degree should in any sense be made a requirement for the obtaining of either a medical degree or the right to practice medicine With the requirement of two or more years of premedical study, medical education in the United States is now on a par with the requirements in other countries There is no objection to any medical school which so desires to require entrance qualifications in excess of two years and students who have the time and means also have the unquestioned right to continue their college education and obtain the degree if they so desire It is believed, however, that provision should always be made for students otherwise exceptionally qualified who cannot obtain the two extra years of college work."

ADOLESCENT RICKETS WITH PRIMARY INVOLVEMENT OF THE VERTEBRAL COLUMN

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AN ORTHOPÆDIO STUDY

Adolescent Rickets with Primary Involvement of the Vertebral Column.—Definition The name implies a primary onset of rachitic disease during the adolescent period or later

In going over the literature dealing with the subject one is impressed with the unanimity of many of the writers that the affection called late rickets is rare

Some authors going even so far as to deny the possibility of the onset of the disease later in life without the patient having an attack of rachitis in early childhood, thus, Sill, when speaking of late rickets says "Late rickets is very rare"

In adolescence, when growth is rapid, bending of bone may occur due to failure of the hardening process of bone to keep pace with the rapid growth of bone but such condition outside of bending bone, is usually not accompanied by any other evidence of rickets¹

Tubby,² after discussing the subject pro and con makes the statement that "Perhaps, the fairest statement which can be made at present is that, although the cessation of the rachitic process may occasionally be delayed to late childhood or adolescence, the primary onset of the disease after infancy is still subjudice"

R Whitman³ says that late rickets is, as the name implies, an affection presenting all the characteristics of the common infantile form This, in rare instances, appears in later childhood or even in adolescence, and in most instances the affection appears to be a continuation, or recrudescence of the infantile form, in others no history of a preceding affection can be obtained

During adolescence, when growth is rapid, there is a period of instability and during that time static deformities develop, or, if already present, are exaggerated, particularly in subjects living under unfavorable conditions who are overburdened or overworked

By many writers the term late rickets is improperly used to explain genu valgum, coxa vara and the like in subjects of this class, although none of the distinctive signs of the disease are present. Bradford and Lovett,⁴ in discussing late rickets remark that late rickets is a disease which affects persons at about the age of puberty, that it may be associated with albuminuria and that its etiological relations are decidedly obscure. The physical signs are the same as in the rickets of early life, except that the epiphyseal enlargement is generally not so great.

Many authors, especially of the European schools, consider the involvement of one joint or absence of a generalized condition as characteristic of late rickets. Thus, Knaggs⁵ quotes Bland-Sutton's opinion, that in late rickets occurring in puberty the peculiar feature of it is the fact that it does not tend to generalize itself, as in infancy when active growth is taking place, but may attack the axial skeleton or the skull only. Jones and Lovett⁶ remark that late rickets manifests itself particularly at the knee, causing a marked knock knee. Riedinger and Schede when discussing late rickets in Fritz Lange's *Lehrbuch der Orthopädie*, are inclined to agree with the findings of V. Recklinghausen, Pommer, Looser and Schmoil, that pathologically and anatomically osteomalacia adolescentium and rachitis are identical morphologically, certain minor variations which may be found can be accounted for by the different growth period in which the patient finds himself at the time of the onset of the disease.

They also emphasize the fact that though some cases may be recrudescent rickets with its origin in childhood, many cases are newly formed rickets which may attack local parts only, but may also involve the entire skeleton. In the localized form of the disease the parts most affected are, in their opinion, the lower and upper epiphyses of the femora, and the spinal column. Pains usually accompany the disease in the part affected. Rachitis in their⁷ opinion is not a disease of childhood exclusively, but may have its onset at any period of life, particularly during the growth period, and that osteoporosis, nightly drawing pains in the extremities, a pain in the pelvic region, may be a result of a thorough study of 103 cases ninety-eight were in the adoles-

(1) Late rickets in its severe form gives a typical picture of the disease

(2) The mild form of late rickets is very prevalent

(3) That late rickets favors spontaneous fracture just like in children and may be the cause of deformities

(4) That the growth deformities are brought about by the sinking in of the diaphysis into the broadened and softened growth zone as a result of mild traumata, and through diminution of growth on that compromised side the deformity increases, and thus coxa vara and coxa valga, genu varum and genu valgum originate

(5) That late rickets is the cause of many flat feet and scoliotics

(6) That even osteochondritis caxæ and osteochondritis of other joints has connection with late rickets

(7) That even Schlatter's disease of the knee may in most cases be due to late rickets

(8) Hence in all disturbances of growth, antirachitic treatment should be instituted

(9) That any fresh deformity, especially in knee deformities (knock knees), a bloodless correction by conservative method is indicated before any other procedure is undertaken ⁸

In summarizing the above opinions one can easily perceive the divergence of the conclusions reached by the respective authors. While some authorities look upon late rickets as a rarity, others concede that it may be found in a number of cases, but not too frequently, while still other writers, particularly the German colleagues hold that late rachitis is frequent in adolescence, and even adults, and they attribute many conditions and deformities to a mild invasion of the disease during adult life.

Primary Involvement of the Vertebral Column in Adolescent Rickets—As already stated, Riedinger and Schede call attention to the fact that the localized form of late or adolescent rickets mostly effects the lower and upper epiphyses of the femora, and the spinal column. The latter region therefore in their opinion may be affected alone without the accompanying involvement of the femora.

In describing the roentgenologic appearance of the affected part of the spine they state "Auch in der Wirbelsäule kommt es zu solchen lokalen Einschmelzungen, die dann rasch zu schweren Skoli-

osen fuhren, oft unter den klinischen Erscheinungen einer Spondylitis "

Translation Also in the vertebral column do we find a fusion of the bodies which lead to a rapid scoliotic deformity and often is diagnosed clinically as a spondylitis

Fromme is even more explicit in his explanation of the causes for crooked spines in rickets

"Dass Verkrümmungen der Wirbelsäule bei der Rachitis des Kindesalters häufig auftreten, ist allgemein bekannt. Dagegen ist es noch immer eine Streitfrage in wie weit die Spätrachitis als etiologischer Factor für diese Verkrümmungen in Frage kommt. Die bisherige Beobachtung hat keimmal das Entstehen einer—Kyphoskoliose gezeigt, wohl aber entstanden häufig Kyphosen. Die Erkrankten gaben wiederholt an dass sie erst in den letzten Wochen oder Monaten einen runden Rücken bekommen hatten. Da histologische Untersuchungen in grossen Umfange anzustellen, wie es Fragenheim verlangt, sehr schwierig sein wird, kann auch hier vielleicht die systematische Röntgenuntersuchung Forderung bringen."

Translation That deformities of the spinal column are very frequent accompaniments in rickets of childhood, is well known

On the other hand, the question of late rickets as a causative factor in deformities of the spine is still a mooted one. Observations to date have failed to show kyphoscoliotic deformities of the spine, but sudden appearances of kyphotic deformities were plenty. Many of the patients stated repeatedly that their round backs appeared in the last few weeks or months. Since histological examination as asked for by Fragenheim is difficult to carry out to a great extent, we can perhaps progress by a systematic study with the aid of X-rays.

Additional Data.—Just as one finds discrepancies with reference to the existence and frequency of the so-called adolescent rickets, so is one doomed to disappointment in scanning the literature for a thorough description of the symptoms and signs of the disease. One may find a valuable point emphasized here and there, and things and appearances which one author considers essential from a diagnostic point of view the other authors have seen fit to ignore.

To illustrate Jones and Lovett give a general description that the relation of this late deformity to osteomalacia is doubtful and the pathology is not clear, but the change seems to consist in a delay

of endochondral ossification associated with the special growth in length of the long bones which occurs at the time of puberty. It has also been associated with a diminished resistance.

Riedinger and Schede are more explicit in calling attention to the cyanotic appearances of the skin, tendency to venous stasis of the hands and feet, as well as exaggeration of reflexes depending a good deal upon the severity of the disease. Fromme,¹¹ in his exhaustive article dealing with late rickets cited above dwells upon the intimate relationship of late rickets with tetany. Engelman,¹² again while speaking of habitual or postural scoliosis, calls attention to the presence of notches, in the ventral portion of the vertebral bodies in rachitis, and that these characteristic notches are never found in abundance nor is the depth of the notches which one sees in rachitic cases found in normal children. He also mentions the fact which has the sanction of all observers that many habitual scolioses in childhood or even in older children may have their origin in mild rachitis. In view of the fact that in the first three years of life the vertebral growth is very extensive, rachitis will attack that part of the body readily.

From the third to the sixth year the vertebral growth is quiescent, the entire length of the vertebral column, according to Langer increasing during that period about one to one and one-half cm. only, and thus during that time the spinal column is not usually attacked by acute rachitis. At the sixth year of life when the spinal column again becomes active in growth, at that time rachitis may again attack the fungous processes of the vertebral bodies and produce deformities. Langer quoted by Engelman¹³

Now, after having studied what others had to say about adolescent rickets or rickets in late childhood let us compare our own findings with those of the other workers in the same field and see whether the observations tally.

Number of Cases—The writer had occasion in the last few years to observe a number of cases whose first manifestations of deformity were in the spinal column, the progress of whose disease I had full opportunity to follow, and to observe, and as a result of which I am ready to conclude that all of these cases were tardy or late rickets, with primary manifestations in the vertebral column.

The reasons for my conclusions are, (1) Because of certain char-

acteristics in the method of onset, (2) because of the radiographic appearances of the involved parts and the surrounding areas, (3) because of the accompanying diagnostic features, (4) because of the improvement of the condition following antirachitic treatment.

Number of patients seen thirteen female, five male, but owing to the fact that only ten gave me their full cooperation and an opportunity to observe them for a long time, I shall use those ten as the material upon which to base my conclusions. Incidentally permit me to remark that, whereas in Fromme's series preponderance of the male sex in adolescent rickets was noted, in my own cases the preponderance of the female sex is marked.

Thus, in his series of ninety-eight adolescent rickets, ninety-two were male, and only six were female.

Age The age ranged in my series between seven and eighteen years of age.

Onset All my cases insisted and so did their parents insist that the onset is recent, and that they were absolutely certain that previous to the onset of that deformity except for their feeling fatigued and exhausted at the slightest efforts, they had no outspoken disease.

One was of two months' duration, one of three months' duration, and with the exception of one case whose deformity of the spine dated back to one year though the onset was sudden then, not a single case had the condition longer than four months.

That the observation of the parents can be relied on is the fact that two of the boys are college students, and sons of prominent physicians of New York, and two of the girls were daughters of school principals, also the parents of the other children belonged to the intelligent class.

Characteristics Painless onset This is contrary to the teachings of many observers, as many of them, especially the German writers, emphasize the painfulness of the involved part, and a painful onset.

None of my patients complained of great pain in the region involved, and were it not for the sudden appearances of a marked deformity of the spine the family would never have thought of the need of seeing a physician.

There was only one exception in A. L., age nine, who had pains at the junction of the ribs posteriorly, at sixth and seventh dorsal

with slight beading at the region accompanied by a slouchy attitude. There is usually a history of weakness and fatigue felt at the slightest exertion for a few months prior to the onset of disease, poor appetite, patient somewhat restless and irritable. All my patients gave practically the same history.

Appearances of skin. All the patients which I have encountered had a marble-like skin, sallow and putty-like, and somewhat anæmic, the appearance of the skin resembling that of a cretin except that the former's skin is moist.

The deformity of the spine may be kyphotic which in early rickets is characteristic but in late rickets, the kypho-scoliosis is quite frequent. In my cases, with the exception of one case, A. L., age nine, whose deformity was purely kyphotic, all other cases were of the kypho-scoliotic type, especially when standing. The spinal deformity is not accompanied by spasm of muscles either on the concave or the convex side of the deformity of the back, and though the condition may resemble a spondylitis, the absence of night pains and spasm of muscles and the sudden onset, should put one on guard.

In all my cases the above characteristics were noted. Accompanying weak feet were found in four, pot bellies with weak feet in two, and the remains of early rickets such as beading of the ribs, a depressed chest (Harrison's grooves) and chicken breast in one case only, a girl of twelve, though the mother could not give a definite history of past rickets.

Reflexes. With the exception of one patient, R. N., age twelve, whose rickets was probably a recrudescient one, and whose reflexes (knee) were somewhat increased, all the other patients gave normal responses to the testing for various reflexes.

Electric Reaction.—The spinal muscles when stimulated by a galvanic current show a great diminution in their response, equally so on both sides of the spinal column. In this connection the writer¹⁴ would like to call attention to a previous study which he has recorded elsewhere, with reference to the electrical stimulation of the muscles of the spine and the reactions, under normal and pathologic conditions. Thus, electrical stimulation applied to the normal spine gives the following characteristic reactions —

When both applicators are applied to one side of the dorsal region, the upper six or seven dorsal vertebræ, while the person is in

prone position on the table, and the arms are so held that the posterior muscles of the shoulder are somewhat contracted and the scapulæ approximate each other, there is a marked contraction of the muscles in that region to a medium galvanic stimulation, with the rotation of the spinous processes of the stimulated side to the opposite side, resulting in a slight lateral bending so as to form a curve with the convexity away from the side stimulated. If the stimulation is marked, the muscles of the entire length of the spine seem to respond, even though the electrical stimulation is applied to the upper dorsal region only. On the other hand, if the arms are slightly abducted and placed in a position so as to relax the trapezi and get the scapulæ away from the spinous region a stimulus applied to the region of the locality mentioned above (the upper six or seven dorsal) will produce a rotation of the spinous processes over to the side of the stimulation, and produce a slight convexity in that region, while the concavity will be directed to the opposite side.

If an electrical stimulus is applied to the lumbar region exclusively, if to one side only, there is a lateral bending with the concavity towards the stimulated muscles, and a slight increase of the lordosis in that region is observed.

In scoliosis of the spinal column we also find certain electrical reactions which are pathognomonic. In early cases there seems to be hypersensitivity on the convex side of the curve to the electrical stimuli. A mild current which ordinarily would not excite a reaction in a normal person may produce pain if applied in such early cases, and the spinous processes of the stimulated region will rotate to the other side away from the contracted muscles. On stimulation of the muscles on the side on which the concavity of the curve is situated a much greater stimulus is needed to get a reaction, at times as much as three times the strength of the stimulus needed to get the reaction on the convex side. Then, when the reaction does take place, it does not have enough power to rotate the spinous processes over to the other side, but stimulates the muscles of the concave side so that the spine will straighten somewhat by pulling the column toward the centre.

In comparing these reactions with the reactions usually found in the cases of adolescent rickets which I had a chance to study, the

significance of the statement that a marked diminution of response to electric stimuli equally on both sides becomes manifest

Recapitulations—(a) Normally the right side of the back in right-handed people will be more alert to electric responses than the left side

(b) In muscle strains and back injuries with accompanying muscle spasm, the side where the muscles are spastic will respond more vigorously to electric stimulation¹⁵

(c) In scoliosis, the convex side of the deformity will manifest a marked hyperexcitability, while the concave side of the deformity will display hypoexcitability, at times, to a marked degree

(d) In those patients whose deformities of the spine accompany rickety manifestations the back muscles display a marked weakness with an accompanying hypoexcitability to electric stimulation equally on both sides of the trunk, convex as well as concave

(e) As the rachitis improves the electric excitability gradually returns to normal to the extent that eventually the electric response may again become more vigorous on the right side of the back, and both sides will respond to greatly reduced currents

CHARACTERISTIC X-RAY APPEARANCES

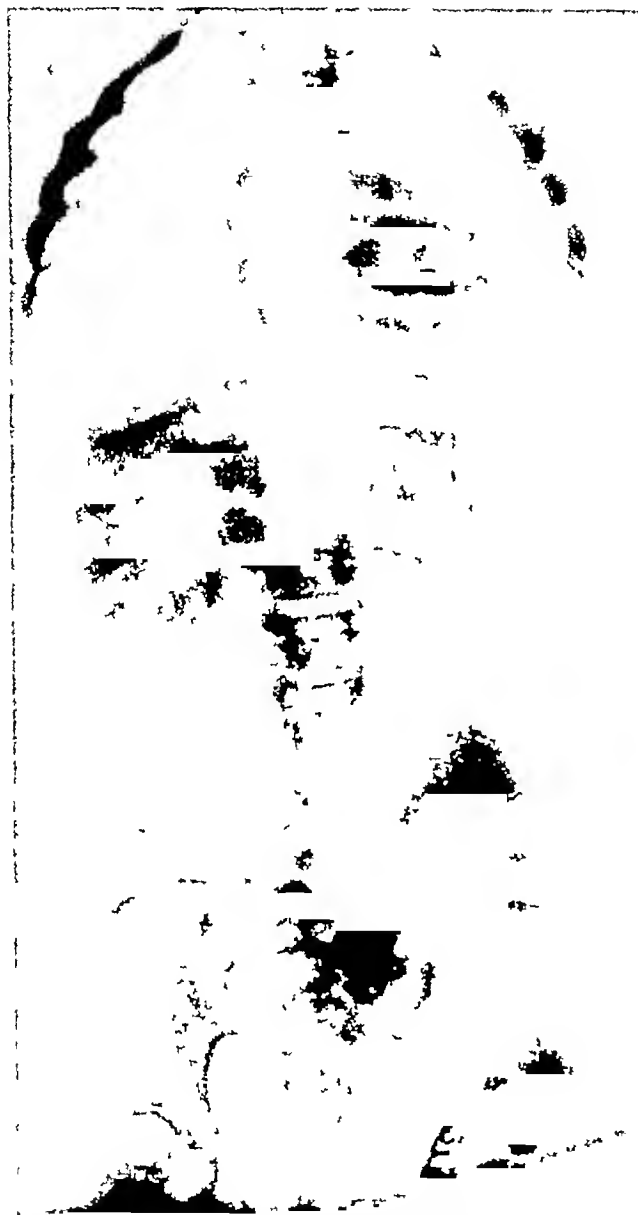
The appearance of the röntgenologic picture is one of the most valuable aids in the diagnosis of rachitis of the spinal column. In severe involvement of the vertebral column one must guard against making a diagnosis of spondylitis which can be cleared with the aid of a clinical study of the case.

Those cases, however, whose symptoms are less severe, and whose spinal deformity is the first manifestation of the condition for which medical aid is sought, a painstaking examination with minimum findings may be richly rewarded by a good rontgen picture, used as an aid and even as a guide.

The following characteristic appearances of the X-ray pictures I found of great assistance, and I am putting them down as I found them.

(a) Thickening of the epiphyseal plates of the upper and lower portions of the vertebral bodies scattered irregularly through the entire spinal column, even in portions where spinal deformities are absent (Fig 1 a and b, Fig 2 a and b)

FIG. 1A.



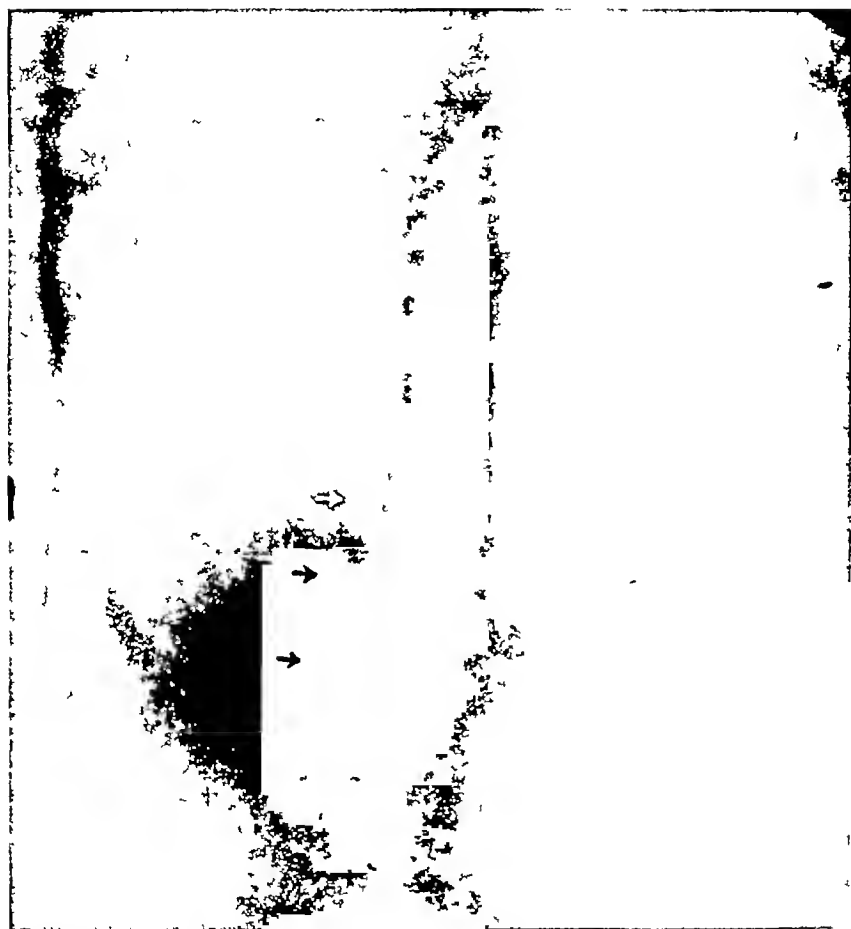
Adolescent rickets Sudden onset accompanied by fatigue and irritability Scattered thickening of cartilaginous plates upper and lower surfaces of vertebral bodies and wedge shaped appearance of 4th lumbar

FIG 1B



Same as FIG 1 Lateral view

FIG. 2A.



Adolescent rickets R N twelve years (r) curvature Lower dorsal—upper lumbar two
months duration (a) Antero posterior view

FIG 2B



Same as FIG 2A (b) Lateral view

FIG 3A



Adolescent rickets M age 17 Lateral curvature Three months duration (a) Antero-posterior view

FIG 3B



Same as FIG. 3A (b) Lateral view

FIG. 4



Page 7 Sudden onset of weakness and slight stoop with tendency to mild lateral curve. The notches are very marked and abundant in this case.

FIG 5A



H R 10 years old Sudden onset of mild curvature accompanied by fatigue on moderate exertion (a) Representing antero posterior view showing standing and lying positions

FIG 5B



Same as FIG 5A (b) Lateral view of same case showing depressions and notches—some vertebral bodies

(b) The epiphyseal plates are noted for their marked glistening appearances in some parts, and indistinct merging lines in other regions, some fuzzy looking in appearance and cup-shaped depressions, as in rachitic involvement of the epiphyseal portions of the long bones (Fig 3)

(c) Notchings or incision-like depressions in the ventral portion of the vertebral body, I have found present in the majority of my cases. Some are deeply notched, others looked punched out with a concave appearance anteriorly and with a prolongation into the middle of the body of the vertebra, making the appearance as if it were cut into. These notchings seem to involve the mid and lower dorsal only, never the lumbar region. They seem to be in direct relationship with the severity of the disease, because improvement of the rachitis will also help make those notches disappear (Fig 4)

In order to be able to observe them a lateral view must be taken of the spinal column, as only in that position can the anterior portion of the vertebral body be properly studied. My observation and conclusions with reference to the importance of these notches in rachitic disease of adolescence tally with the findings of Engleman,¹⁶ although I have drawn my conclusions independently of his, some years ago, and only lately have I come across his writings on the subject.

(d) In cases with mild rickets with a weakness of the spinal muscles and ligaments, and in consequence the presence of a lack of stability of the spinal column, there will be a marked difference in the appearance of the X-ray of the involved portion of the spinal column between the recumbent and standing posture of the patient, the reason being that in a standing position, because of the relaxation of the muscles and ligaments, there is a falling forward of the bodies of the vertebrae, and a buckling appearance results, while in the recumbent posture the embarrassment of the unprotected bodies is relieved, and thus the seeming deformities disappear. It is worth while to bear this point in mind as a good many physicians are in the habit of examining their patients fluoroscopically, and thus may trip up on the cause and extent of the deformity (Fig 5)

(e) There may also be present the usual rachitic appearance of the ends of the ribs at its junction with either the sternum or the posterior part, the flaring out of the ends, or the frayed out appearances may be seen

LOCATION OF LESIONS

As I have mentioned before, epiphyseal enlargements in the spinal column can take place in any portion of the column, even at the ends of the ribs, the notches in the bodies of the vertebra which I have spoken of at length are usually found in the mid and lower dorsal, never in the lumbar, region. On the other hand, marked changes in the bony structure of the spine following or complicating a rapid advent of adolescent rickets is always found in the lower dorsal and entire lumbar region. The reason for the particular predilection for the involvement of that region may be static, but I suspect that there may also be an additional cause which is as yet obscure, because these marked deformities predominate in women. In male cases the changes in the bodies of the vertebrae are not so marked and the ultimate prognosis as to the restoration of the patient to normalcy is more to be expected in the male cases than in the female. For a full discussion of the subject the reader is referred to the paper on "Clinical Mobility of the Spine," mentioned before, where the reasons for the preponderance of curvatures in the female is discussed, and where it is pointed out that the lumbar-sacral region differs in shape, angle and projection and size in the two sexes, especially so at puberty.¹

BLOOD FINDINGS

In looking for the presence of reduction of calcium and phosphorus for the purpose of clinching the diagnosis one is bound to meet with disappointment. Theoretically there is supposed to be a reduction of calcium and phosphorus in the blood. T. O. Neff in his article on rickets in Tiee's "Practice of Medicine,"¹⁷ when speaking of blood chemistry in rickets of childhood, remarks that the characteristic chemical finding in the blood is the lowered phosphorus content. The normal quantity ranges from four to five milligrams per 100 c. c. of blood. In active rickets a content below 3.5 mg per 100 c. c.

Normal blood calcium ranges from 10.0 to 11.0 mg per 100 c. c. of blood. It is generally regarded as little affected in rickets.

Certain investigators, however, believe that rickets may be of two varieties, one with low phosphorus content and the other with

¹ *Archives of Surgery*, March, 1924

low calcium In adolescent rickets, however, the above blood findings are not frequent and though positive blood findings will facilitate the diagnosis, the negative does not rule out the disease Only one of the cases had a perceptible diminution of the phosphorus in the blood

The case was J D, twelve and one half years of age, daughter of a school principal with proper environment, and a good healthy family history Weight ninety three and one half pounds. She came to my office on October 16, 1927, for an incipient scoliosis of two months' duration, and fatigue after moderate exertion, which was detected by the mother and confirmed by the family physician, who referred the case to me

Examination showed a sallow skin, with flabby musculature, slightly anemic, pale mucous membrane, heart normal, clear chest, reflexes normal, spleen somewhat enlarged, with a right dorsal curve and left lumbar of very mild degree No spasm of spinal muscles, hyposensitive to electric stimulation on both sides of back. Motion of back quite free Both lower extremities of equal length.

The X ray findings were Epiphyseal portions of the lower dorsal increased in thickness and volume, while other vertebral bodies had indistinct and fuzzy looking cartilages The ventral portions of the dorsal of the lower regions were cup shaped and frayed There was a double scoliotic curve in the dorsal lumbar region in the erect posture which disappeared completely when patient was placed in recumbent posture Upon these symptoms and signs enumerated above I have diagnosed the case as late rickets, though the extremities were not involved.

The diagnosis was confirmed by Dr I Newton Kugelmass, in whose care she was placed for her metabolic correction, who wrote that the girl is suffering from nutritional dystrophy with active rickets and secondary anemia with the following blood findings Hemoglobin 65 per cent, red blood cells 3,300,000, calcium 8.6 mg per cent, phosphorus 2.6 mg per cent. The last note sent to me by the doctor in response to my inquiry as to the present condition of the patient was to the effect that she improved nutritionally on an antirachitis basis dietary régime paralleled by orthopaedic treatment

IMPORTANCE OF EARLY DIAGNOSIS

In early cases when the perceptible deformities of the spinal column are due to relaxation of the surrounding muscles and ligamentous hinges, evidenced by the possibility of correcting the curve as soon as the patient assumes the recumbent posture, a perfect cure can be predicted with certainty, provided the orthopaedist is able to receive the cooperation of the patient's family It must therefore be made clear to them that though the disease as it is at present looks mild and unpretentious, the tendency of the deformity is to become more pronounced as time goes on, . . . pre-

ventive measures are taken immediately I have never found it difficult to convince the people of the seriousness of the condition

More so is it essential for the orthopædist himself to recognize rickety involvements of the spine before definite changes have been permitted to take place in the vertebral column, and which changes make the deformity a fixed one. It is true that many cases may come to the physician with the deformity already well established and then our duty is to make the best of it, but in those cases, who make it their business to come at its incipency, it is our duty to make the most of it in a preventive way

TREATMENT OF RACHITIS OF THE SPINE

All the cases which I have encountered have already had a course of treatments with gymnastics. Two of them have been advised operative interference in order to prevent further bending of the spine

I feel it, therefore, my duty to emphasize that in cases of late rachitis of the spine, not unlike rachitis in childhood, even in mild cases, rest is indicated. Recumbent posture is the only posture that will relieve the patient's fatigue, and also will relieve the patient's irritability. The straightening of the spine and the disappearance of the scoliotic curves, when the patient assumes the recumbent posture in those weak-backed rickety cases, show us the way, and it is our duty to follow nature's lead. In addition to rest, cod liver oil, two drachms, three times a day, after meals, and elixir of phosphorus, one drachm, three times a day, before meals, taken internally, has given me encouraging results. Some of the patients could not tolerate the cod liver oil after a while. Those patients I gave olive oil, two drachms, three times a day, which oil has been exposed to the Alpine rays for ten minutes

Rest, nourishing food and the above remedies for six weeks to two months, with mild exercise of their limbs while the patients are on their backs, will prepare them for the treatment with supports, and corrective gymnastics, which latter should be very mild at first, and increased gradually as the patient improves and is getting accustomed to it.

These cases should be given a removable support by preference,

as it is essential that the musculature which is not spastic but weak should be given a chance to develop

A mild Faradic or sinusoidal current applied to the back muscles will assist in the restoration of muscle tonus, and help the patient to regain confidence in assuming the erect posture. By no means should ankylosing operative procedures be instituted for its correction, especially early in the disease, as the cure is worse than the disease.

RECAPITULATION

(1) Adolescent rickets without any history of rachitis in childhood is not as rare as a good many authors would have us believe

(2) The possibility of a primary rickety involvement of the spinal column should be borne in mind

(3) Sudden appearance of a slight deformity of the spine in adolescent age, preceded and accompanied by exhaustion or marked fatigue after moderate exertion, with a lack of spasticity of the back muscles where the deformity is located, and with the presence of hypoexcitability of the convex as well as the concave side of the scoliotic deformity, rachitis should be thought of as a first consideration

(4) The X-ray appearance of the spinal column is of great diagnostic importance

(a) The pictures should be taken with the patient in erect, as well as recumbent posture, in order to observe the influence of the posture upon the apparent deformity

(b) It is essential that antero-posterior and lateral views be procured in order to be able to observe every deviation from normal

(c) Extraordinarily thickened cartilaginous plates of the upper and lower ends of the vertebral bodies, and indistinct demarcation lines at the epiphyseal regions in other vertebral regions, cup shaped and frayed appearances of the ventral parts of the vertebral bodies, or notches in the ventral part of the bodies of the vertebrae, are sure signs of rickets, and if recognized early will save the physician much embarrassment

During the rickety stage the patient's resistance, being lessened, is exposed to many infections such as inflamed tonsils, caries of teeth and many others, especially of a chronic nature, and one

must always be on his guard against taking the effect for the cause, and thus overlook the real diagnosis of the true condition

Bradford and Lovett, when discussing the subject of lateral curvatures remark that "if cases with rickets were more carefully examined scoliosis would be more frequently observed" I should like to paraphrase the remark by the statement that if cases with the so-called idiopathic and postural scolioses were more carefully examined rachitis would be frequently found

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THE SURGICAL CONSIDERATION OF CHRONIC ULCERATIVE COLITIS *

By EDMUND HORGAN, M D , and JOSEPH HORGAN, M D
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CASES of chronic ulcerative colitis in which medical measures have failed are occasionally referred to the surgeon for an opinion as to whether any form of surgical treatment can give the patient relief. The two methods of operation most frequently used to accomplish this are (1) the division of the ileum with enterostomy, by which means the fecal current is diverted through an artificial anus in an attempt to facilitate the healing of the ulcers by relieving the colon of material which may irritate it, (2) appendicostomy or cecostomy, by which means the colon can be medicated and can also be irrigated to keep its ulcerated surface cleaner. Either to excise the diseased portion of the colon, or to short-circuit it by means of an ileo-sigmoidostomy is a measure that has not proved helpful.

When a case of chronic ulcerative colitis is referred to a surgeon he should learn if the diagnosis has been definitely established. All other varieties of colitis should be excluded. A diagnosis of chronic ulcerative colitis can be established by a clinical history, a sigmoidoscopic examination, and bacteriological and roentgenological studies. A history of frequent watery stools containing mucus, pus, and blood, the characteristic lesions of the mucous membrane seen through the sigmoidoscope, the finding of the diplostreptococcus of Bargen,¹ and the tubular colon shown by the roentgen-ray are the chief factors in arriving at a diagnosis. Only by these means can a correct diagnosis of chronic ulcerative colitis be made as the symptoms long associated with this disease—diarrhoea with mucus, pus, and blood in the stools—are common to other forms of colitis as well. A bacteriological study of the stool yields little diagnostic evidence, as the flora of the colon seems to depend not only on the pathological condition of the colon but on other unrelated factors.

* Presented before the Surgical Section of the Medical Society of the District of Columbia, October 25, 1929

Pain, tenderness, abdominal distention, and loss of appetite are variable and are as frequently present in other forms of colitis

As the name, chronic ulcerative colitis, suggests the disease is a chronic condition beginning usually, though not always, with a mild intestinal disturbance which recurs with an increasing softening and frequency in the stools until diarrhœa becomes pronounced. The patient is often doubtful about the beginning of the disease as it may have existed for a long time in so mild a form that he has been unaware of having a disease of the colon. There may, at a later period, be a rapid progress in its development which would give the impression of an acute condition. Usually it is weeks or months, or even a few years, before the stools become liquid, with mucus, pus, and blood appearing in them. There may be eight or ten stools a day and in the most advanced cases a much greater number. In one of our cases the patient had lost sphincter control and there was a continuous discharge of mucus, pus, and blood. In mild cases, or during periods of remission, the mucus, pus, and blood may appear in the stools in such slight amounts as to be almost negligible, while in more severe cases it may form the greater part of the stools. There is usually little pain or abdominal distention. Loss of appetite and weakness may come as the disease develops, and in severe cases emaciation may follow. In the early, mild stages the patient frequently carries on his normal activities, in the advanced stages emaciation and weakness may force the patient to remain in bed. Remission and recurrences are characteristic of the disease and with the chronicity mark it from other forms of colitis.

The use of the proctoscope or sigmoidoscope is indispensable in establishing a diagnosis with any certainty. Hurst² in emphasizing the importance of their use in diagnosing the various forms of colitis has said "Nobody would think of treating a case of tonsillitis without looking at the tonsils, it is even less justifiable to treat a case of colitis without looking at the colon, because the symptoms are far less distinctive." The ulcerated surface of the colon presents a fairly distinct appearance which varies with the progress of the disease. In the early mild stages the mucosa of the colon is granular, diffusely hyperæmic, and somewhat cedematous. It is easily broken and bleeds with the lightest touch. The ulcers when present are scattered. In the more advanced stages the mucosa becomes swollen,

œdematous, and hæmorrhagic. The ulcers are numerous and confluent. In the center of each ulcer there is a yellow exudate, which when wiped off leaves a red, bleeding spot.

That the roentgen-ray is also an important means in making a correct diagnosis of chronic ulcerative colitis has been demonstrated by the work of Carman and Moore.³ Here again the findings in the early stage differ from those in the later stages, so that the x-ray may show only the spasm which is caused by the irritation of the inflamed mucosa, or it may show the narrowing of the lumen and the absence of haustra which is typical of well-developed cases of chronic ulcerative colitis. There may be an occasional stricture caused by a deep ulcer, and in rare cases a more extensive contraction.

The conclusive evidence to be used in making a diagnosis in chronic ulcerative colitis is the isolation of the diplostreptococcus which has been attributed to be the causative factor of this disease. This organism was described by Bargaen,¹ who in a series of sixty-eight cases, during a two-year period at the Mayo Clinic, repeatedly isolated a Gram-positive, lancet-shaped diplostreptococcus from material taken from the depths of ulcers in the colon of patients having chronic ulcerative colitis. When he⁴ injected cultures of this diplostreptococcus intravenously into 459 rabbits, 28 per cent of them showed lesions in the colon and 30 per cent developed diarrhœa. Other strains of streptococci injected into rabbits during the same period of time produced lesions in the colon in not more than 2 per cent of the number. Twenty-five out of twenty-eight dogs treated with injections of pure cultures of the diplostreptococcus developed ulcers and hæmorrhages. In 1928 Bargaen⁵ reported that of 250 patients at the Mayo Clinic treated with vaccine injections during the years 1924, 1925, and 1926, 43 per cent were free from symptoms and 70 per cent. were able to resume a normal, active life. The results in a small series of cases which we have recently reported⁶ have tended to confirm Bargaen's conclusions that chronic ulcerative colitis is an infectious disease with the diplostreptococcus as the primary causative organism. This organism was found in bacteriological studies in the five cases referred to us in which the diagnosis of chronic ulcerative colitis was further established by sigmoidoscopic examinations and roentgenological studies. In each case material for culture was obtained according to the method

worked out by Bargen.⁴ After the bowel had been properly cleansed, the sigmoidoscope was passed and several ulcers were rubbed with cotton until the base of each was free from exudate. By curetting with a long platinum loop, material for culture was obtained from these bases. This material was used to inoculate culture media, vaccine and bacterial filtrate were prepared from the diplostreptococci of Bargen which were isolated, Rosenow's technic being followed in both processes. The autogenous vaccine and bacterial filtrate were each injected subcutaneously in the patient each week, three or four days apart, over a period of four months. The dose of each was 0.5 c.c. to start with and after a month this was increased to 1.0 or 1.5 c.c. In each of the five cases the patient showed decided improvement after the first four or six weeks of treatment. This improvement continued, and when the treatment ended in no case did a sigmoidoscopic examination reveal an ulcer in the colon. These five patients presented various stages in the development of the disease. One patient who had lost forty pounds in weight and had been bed-ridden in a hospital for about three months was in an extremely grave condition. At the time we reported his case, he had had no return of symptoms in two years. From a recent communication we learn that he is still well. Bargen⁷ reports that Rosenow has recently immunized horses against the diplostreptococcus found in cases of chronic ulcerative colitis. He has used the serum with satisfactory results in the treatment of very severe cases of the acute fulminating ulcerative colitis. Of the seven cases in which the serum treatment was used, two patients recovered and five improved, two of these, however, died later, one after an ileo-sigmoidostomy had been performed for a suspected malignant condition and one from a chronic condition. Previous to the use of serum injections the methods of treatment in the acute fulminating phases of the disease were not as satisfactory and the mortality rate was higher.

Lockhart-Mummery⁸ noted that, "at the discussion on ulcerative colitis which took place at the Royal Society of Medicine in January, 1909, figures were obtained from most of the London hospitals, and they proved that the mortality up to that date was over 50 per cent." Logan,⁹ in 1918, reviewing 117 cases of chronic ulcerative colitis, stated that, "the prognosis in chronic ulcerative colitis is

serious There are a few cures, but mortality is high—7.5 per cent. in those patients who stayed in the clinic under medical treatment but a short time, and 27.5 per cent in those patients who underwent operation” Bargaen,⁵ in 1928, reviewing the mortality of chronic ulcerative colitis at The Mayo Clinic during the years 1920 to 1927 inclusive, found that the mortality in cases treated medically had dropped from 17 per cent in 1923, the year before the vaccine treatment was begun, to 3.4 per cent in 1927

In view of this substantial decrease in the mortality rate of chronic ulcerative colitis with the using of autogenous vaccine treatment, it would seem advisable that before surgical treatment be recommended repeated efforts should be made to isolate the causative diplostreptococcus If the organism be found, a vaccine and bacterial filtrate should be made and the patient treated with injections

In cases in which the organism has not been found after repeated efforts to isolate it, and in cases in which it has been found but relief has not been obtained through injections of the vaccine and bacterial filtrate, surgical treatment may be considered As the discomfort to a patient from the symptoms of a mild form of chronic ulcerative colitis is much less than the annoyance and trouble which follow a division of the ileum with enterostomy, it would be inadvisable to suggest that this operation, or even an appendicostomy, be performed in the mild stages of the disease On the other hand, with failure to find the organism or failure to obtain a cure with the vaccine and bacterial filtrate injections in a case in which the patient is growing progressively worse, it would be better not to delay the enterostomy too long This has been emphasized by Stone.¹⁰

When division of the ileum with enterostomy is performed, the surgeon is always hopeful that the patient will improve sufficiently to make possible a re-establishment of the continuity of the bowel at a later date Few, however, improve sufficiently to have the anastomosis of the ileum made Most patients on whom an enterostomy has had to be performed have grown gradually worse and died This is probably due to the emaciated and weakened condition in which the patient comes for surgical treatment.

It seems fairly certain that Bargaen's investigations and findings have established the etiology of chronic ulcerative colitis, that the giving of vaccine and bacterial filtrate and recently the giving of

immunized horse serum have made more patients symptom-free and have reduced the mortality more than has any form of treatment which had previously been advocated, and that as a result of Bargen's work fewer cases will require surgical intervention

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THE IMPORTANCE OF A SCIENTIFIC FOUNDATION IN MENTAL HYGIENE¹

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WE ALL know in any real progress, the importance of the foundation. The great Teacher, in one of his well-known parables likened the need of the foundation to "a wise man who built his house upon a rock and the rain descended and the floods came and the winds blew and beat upon that house and it fell not for it was founded upon a rock"

Dr Frank Billings, in a presidential address delivered at the twenty-fourth annual convention of the Nu Sigma Nu Fraternity, said, "Fifty years ago the practice of medicine was based upon philosophic theories and empiricism" The foundation, the rock, had not yet been found for the enduring structure of modern medicine, although in the anatomical studies of Galen, the physiological researches of Harvey and the contributions of Jenner, the material was being prepared for it Again quoting from Doctor Billings "Real modern medicine, as we understand it today, dates from the epoch making discoveries of Louis Pasteur in bacteriology and immunology"

In the field of therapeutics and physical hygiene previous to this time, pretty much everything depended upon empiricism which the dictionary defines as mere experience and quackery Of course, we must acknowledge that experience may be a very good teacher sometimes, but in the absence of scientific fact upon which to base it, without a scientific foundation, it can and very often does furnish as many diverse opinions on the same subject as there are differences in the personal pathology of the authors of these opinions

We only need to be reminded of the therapeutic efforts of our medical forefathers as well as many of our own where we seek to progress by the aid of that weak and treacherous staff, *opinion*. In the realm of therapeutics we may cite one example

¹ Presidential address before the Eighth Annual Convention of the Central Neuropsychiatric Association, Denver, Colorado, September 27, 1929

We are old enough to have had a personal experience in the treatment of diphtheria before the time of the recognition of its causative factor and the use of antitoxin. We have seen the throats of the diphtheritic sufferers choked with membrane, the black cracked lips, the filthy excoriating discharges coming out of the mouth and nostrils. We have faithfully and persistently faced the stinking breath in order to apply the various sprays, local applications and insufflations recommended *in the opinion* of the best authorities on the subject as the most efficient applications but without a scientific foundation. We have observed the wonderful contrast in the treatment of diphtheria with the antitoxin therapy built upon the scientific rock.

The same situation existed in preventive medicine as in therapeutic medicine. Until there was the scientific basis of bacteriology and immunology, physical hygiene lacked a foundation. Much of it as in therapeutic medicine lay in the field of empiricism with its conflicting opinions. Not much of any real progress had been made up to the time of these scientific discoveries in the handling of epidemics since the occurrence of the great plague in the seventeenth century in London when the authorities, in a wild endeavor to do something to control it, killed all the dogs and cats, having *the opinion* that they in some manner might be responsible for the spread of the contagion.

With the knowledge we now have of the great plague and its means of conveyance on the basis of scientific discovery we know that the London health officers of that period when they ordered the killing of the dogs and cats really, instead of doing something to stop the plague, did just the opposite. In killing the dogs and the cats they made life more secure for the flea-infested rats which were the real carriers of this disease.

In looking over the names of the illustrious men who brought physical hygiene to its present high degree of efficiency and removed the threat of epidemics to civilized communities, we do not find the names of any philosophers, although philosophers in the realm of pure thought and reason stand very high. We do not see the names of rulers of state, prime ministers, eminent representatives of the majesty of the law, celebrated theologians, great writers, social reformers, etc.

Naturally we could not expect to find the names of such people, because they are unacquainted with the intimate scientific facts as to the nature of the diseases which cause epidemics. They could only express their opinions in the same manner as the London health authorities did at the time of the visitation of the great plague. If we were to look up the advice which the Health authorities were given, coming from such sources at that time, no doubt we would find as much difference of opinion as to ways and means of successfully dealing with the disease as we would receive now if we sought advice from our present-day philosophers, eminent statesmen, theologians, social reformers, luncheon clubs, women's organizations, etc., as to the best means of solving the prohibition question. There would be plenty of *opinions*. We feel quite sure of this but each one would be largely colored by the personal bias, the conditioned inherited emotional reactions of the particular individual or organization. As for example, if we submitted the same questionnaire to the exalted ruler of the honorable order of Eagles and the president of the Women's Christian Temperance Union, we would in all probability receive in answer to our questionnaire a different expression of opinion on this subject, perhaps quite different and yet the intelligence quotient and educational opportunities of both these individuals may have been much the same.

In the tariff discussions which are going on in our Senate today, there is no suggestion whatsoever that the Senator from Massachusetts has any less mental capacity, reasoning power or personal integrity than the Senator from Colorado and yet such being the case, they are presenting absolutely conflicting opinions concerning what items in the tariff need an increase and what do not.

If we leave out of our consideration the so-called authorities and observe the behavior of what the politicians are pleased to call the common people, we find there the same difference of opinion as exists among those in high position.

We wonder if any of you have had the privilege of sitting for three or four days in succession in attendance in court during the trial of a will case where the validity of the will depended upon the mental capacity of the deceased. For the duration of the plaintiff's side of the case you observe honest-looking men and women of fair intelligence and education giving testimony under oath to tell the

whole truth and nothing but the truth and a summary of their testimony when it is all in, is that the deceased was in such an unconscious state that he could not recognize his wife and children, that he had no idea where he was in his own bedroom, and as for writing his name, that he was absolutely unable to swallow even a teaspoonful of water when put in his mouth at the time of the making of the will.

After you have heard the testimony of these honest and intelligent appearing people, you marvel that there could have been any question of lack of capacity in this case and feel that somebody must be trying to put something over

But wait, there are two sides to every question, especially in such matters as are not founded upon scientific rock and where interests clash

The defense now introduces its witnesses and they are also respectable men and women such as you are meeting all the time in your daily contacts, no doubt coming from the same environment as the witnesses for the plaintiff, of equal intelligence, education and integrity. The substance of the testimony of all the defendant's witnesses was to the effect that the deceased was in complete and full possession of his mental faculties at the time he made his will. There could be no reasonable doubt of this in their minds. All of which goes to prove that intelligence, education and even honesty, while exceedingly important and necessary, without any scientific background for their direction, only bring us a multiplicity of diverse opinions, any one of which may be as good as another but for the cause of real progress in human welfare as to whether it may be advancing or receding, may be compared with the momentary ebb and flow of the tide.

It is not education, reason or even mental capacity *per se* which is the principal directing force in our thought and behavior. No, it is something else which lies deeper and is more inherent and constitutional in us than this. In the daily press we have read that the girl bank bandit of the Lone Star State was a very brilliant student in the University of Texas and had an M. A. degree.

Aristotle, nearly four-hundred years B. C. in one of his talks to his pupils said, "When we desire to have our shoes mended we take them to some one having had experience in the mending of shoes

Is it not a strange thing when we wish to select a ruler, an executive of a state and nation, we feel for this job no previous experience or education is necessary?" It was strange in Aristotle's time but still stranger in this world so well provided with educational facilities and scientific data and with the world's experience before us that we are still selecting our rulers, at least many of them, in the same old way

Lord Dawson, when the International Clinics Association held its meeting in St Paul, said at the banquet that no real progress was ever made in medicine that did not proceed on a scientific basis, that the wonderful triumphs of modern medicine were entirely made possible on the basis of scientific fact. He expressed great regret that in our other affairs of life we had shown so little inclination to enlist the aid of scientific truth.

It is truly a curious thing and worthy of observation in this time of great scientific achievement and almost universal education that this generation especially has so completely embraced the things which scientific discovery has given us that add to our physical comfort and convenience in life and has not only rejected but called everything which science has brought us which has not been in harmony with this physical comfort as reactionary and out of date.

No doubt you are all wondering by this time where we are wandering, and how these remarks apply. It is our introduction to the subject of mental hygiene which very intimately concerns this association, as in this association and similar ones, such as the American Neurological, are to be found the men with the scientific information and clinical experience requisite to give successful scientific direction to this most important subject.

We like this comparison of mental hygiene with physical hygiene. It seems to us so pertinent, only mental hygiene is infinitely more important to the world's progress than physical hygiene. Physical hygiene undoubtedly has stayed epidemics which otherwise would have wiped out families and even whole communities, but a lack of knowledge in mental hygiene with no sufficient scientific background to go on has in times past destroyed civilizations and will undoubtedly do so again if we ignore the scientific truth which science is bringing us on this subject, which we seem very much thus far disposed to do.



Last spring, our President, a highly intelligent, well-educated person, appointed a Crime Commission, broad in character representing nearly all sections of the country and all walks in life except the medical profession. It should seem pretty plain to most people at least when they come to think about it that a Crime Commission was unnecessary without criminals or individuals who at times are criminally disposed, also that these criminals have constitutionally and inherently nervous mechanisms which in their fundamental reactions are different from those of individuals with normal behavior. It should also be plain that the doctors would be the only ones who were most apt to possess the necessary knowledge concerning these mechanisms.

We wonder how many philosophers, statesmen, jurists, theologians and 'social reformers have any scientific knowledge about them. Of course they have *opinions* on the subject and no doubt could quote statistics *ad infinitum* and give reasons and arguments to substantiate these opinions, but if these opinions were subjected to the light of scientific truth they would be found to be of much the same nature as the opinions of the Senator from Massachusetts and the Senator from Colorado on the tariff question. An old French saying states the situation very simply "The heart has reasons which the reason knows not of."

Out of all these opinions of the various authorities mentioned we doubt if any more valuable ones would be obtained really to stop this epidemic of crime than was obtained from the seventeenth century officials when they tried to check the spread of the black plague by ordering the killing of the dogs and the cats.

What Doctor Billings said about the importance of bacteriology and immunology to physical hygiene may be said also of the autonomic nervous system in its relationship to mental hygiene. Without a fundamental knowledge of the workings of the autonomic mechanisms and their influence on behavior, no real progress will ever be accomplished.

All effort, as in physical hygiene before the epoch-making discoveries of Pasteur, will be built upon the shifting sands of philosophic theories and empiricism.

We have seen in such illustrations as the different viewpoints of the exalted ruler of the order of Eagles and the president of the

Women's Christian Temperance Union that education and environment do not change to any appreciable extent the deep flowing current of the expression of man's whole system, which may be called his personality. Both of these above-mentioned individuals, if their education had been extended to that of Ph D's would still be as widely divergent in opinion on the question of prohibition as they are now. This difference in their personality is infinitely deeper and more resistant than the reason and logic of their brain cortex and also very much older. We do not doubt but that a careful scientific observer might have noticed some of these differences manifesting themselves even away back eons of years ago when the beginnings of these two widely opposite personalities were still mere protoplasmic entities.

We will not presume to take up much time in a description of the autonomic system before this association, the members of which no doubt are more familiar with the subject than we are. We would like simply to say, however, that the autonomic system is the foundation of all life, as our legal friends would express it, the *sine qua non*, that it existed in man millions of years, if we are to believe the teachings of the biologists, before his higher cortical centres were developed. Flechsig, the celebrated German anatomist, has said, "It is not only man's older nervous system but it is the much more tenacious and resistant in comparison with the cerebral spinal system." In anesthesia the functions of the brain cortex succumb more easily to the anesthetic than do the functions of the autonomic nervous system. With absolute unconsciousness, respiration, heart beat, perspiration, digestion, kidney elimination, etc., go on much as they did during consciousness, in many instances even better. We are also during the unconsciousness of sleep subject to the most intense emotional reactions expressed in the form of dreams as the result of autonomic stimulation.

Dr. Albert Kuntz of the St. Louis University, in a Mayo Foundation lecture says, "In view of the rôle of the autonomic nervous system in emotional states and in visceral disorders, it may be assumed that under certain conditions autonomic dysfunction may precipitate or maintain abnormal affectivity. In view of all the data available psychosis must be regarded as the result of changes in the entire system. Affective behavior is a function of the whole organism.

The emotional life of the individual is determined in a large measure by the functional balance of the autonomic nervous system "

Concerning the importance of our emotional life, permit us to quote what Dejerine said many years ago "Reasoning by itself is indifferent It does not become a factor of energy or the creator of effort but the moment an emotional element appears the personality of the subject is moved and affected by it " We see the truth of this emotional autonomic factor in all our affairs

Women have long made use of the powerful dynamic appeal of the autonomic system in their management of man who sometimes styles himself *homo sapiens* No woman presents a monthly expense account or a bill for a new hat to a hungry and tired husband "Hubby" might be said at such a time to be off his autonomic balance Neither does she make her appeal on the basis of logic and reason No, indeed She ignores entirely the fore brain where the intellectual and reasoning qualities of her *homo sapiens* are situated and strikes straight and direct at his autonomic system

She gets him a good dinner, gives him a few affectionate pats, tells him with fond looks how much she loves him, perhaps throws in a few hugs and kisses for good measure When she perceives that he is autonomically comfortable she proceeds like the diplomat she is to the business in hand

We have not only failed to recognize the power of the autonomic system in human comfort and behavior in the past but we are just beginning to appreciate the force of it in our nervous and mental patients We do not feel any more, that the patient who comes to us complaining of a severe depression, a lack of ambition and interest in life together with the multitude of physical discomforts which accompany such conditions and which our ordinary methods of examination will not reveal, can brace up and snap out of it at will We know now from many easily recognized symptoms of autonomic dysfunction that such a patient is autonomically miserable—often much more so than those suffering with severe physical disease

Yet the friends and relatives of such patients and very often, we are sorry to say, their family physicians, persist in taking the attitude that they are able to do this

The other day a woman brought her husband to us suffering with a depression with its accompanying symptoms She cast at him a

disapproving look and said she had repeatedly urged him to forget it and brace up. We recognized at a glance, not at the patient but at the woman, that an appeal to reason was out of the question. The lady was evidently from Missouri. So we said to the patient, "Stick out your tongue." His tongue was covered with a thick heavy coat so often seen in depressions. We asked the woman to look at that tongue, then we showed her ours which was fortunately clean that day and took her up to a mirror and had her observe her own. In this way we demonstrated to her her husband's autonomic dysfunction.

In our future management of great problems in mental hygiene upon whose right solution the saving of the present civilization depends, we are going to find that the attitude of the world will be much like that of the lady towards her husband. The world will also be from Missouri and will need to be shown.

Even then there will be not a few whose emotional reactions are so biased and the horizon of their consciousness so limited, so schizophrenic as it were, that they will persist in believing that the world's war and mere intellectual education and more and more of it will solve this problem. We in medicine have learned by experience something which it appears the educators have not yet learned, that because a little of a thing is good, it does not naturally follow that more is better. If we pursued that idea in our dosage our mortality would be even greater than it is now.

The leader of the Zionists is still teaching that the world is flat even though the *Graf Zeppelin* has just sailed around it and there are many people in the world who still do not believe in vaccination.

We have to recognize in such people that the emotional stream sweeping up from their midbrain makes them in their opinions so decidedly schizophrenic, so restricts the horizon of their consciousness as it were, that automatically and spontaneously in all walks of life they constitute a menace to every constructive effort. They occupy to society about the same relationship as sand burrs do to a dog. It is not that the intelligence average of such people, their I. Q., is not high enough, for in many purely intellectual undertakings they often show much brilliancy.

With our better understanding of nervous conditions we are recognizing more and more what may be designated as episodal

attacks in our nervous cases and their very great importance because of the emotional factors which accompany them

As for example, we had a patient some time ago who had a great fear of getting in a crowd and of crossing the street. We will say in advance that this was not a case of psychoanalysis. In the course of several visits of the patient the reason for the patient's fear was ascertained. Sometimes while she was crossing the street or when she was in a crowd she would momentarily "lose her legs" as she expressed it and have the sensation as if she were left hanging or suspended in the air. This feeling was so terrible to her and her sense of helplessness so great when she had one of these attacks that she lived in constant fear of them and lost all confidence in herself in going around. The explanation of such a case is the explanation of the epileptic attack, the so-called psychic epileptic equivalent, one of the manifold disturbances of consciousness which we are seeing in our patients every day who are subject to episodal occurrences. Some sudden dysfunction of the autonomic system which shuts off some part or all of our normal consciousness for the duration of the attack according to its intensity and nature. In this case it happened to be just the legs which were lost from consciousness.

In our hospital work we come frequently in contact with the so-called spree man, otherwise known as the dipsomaniac. Now all our lives we have never been able to understand these individuals. They are usually quite successful persons, especially during their earlier years and when not in their sprees, ambitious, industrious, law-abiding, home-loving persons.

Why they should suddenly leave the even tenor of their way and start on a mad career of the destruction of all which they had been striving for and valued in life was not easy of understanding to the ordinary normal man who judged them according to his knowledge of himself and the conduct of other normal men. The world has called them fools, idiots, brutes, everything disrespectful which they could think of, has tried by all ordinary means but not upon any scientific foundation to reform them and when they would not reform condemned them still more.

A scientific knowledge of the autonomic system will teach us if the power of our emotional reactions are not too strong that a law upon our statute books, yes, even in our constitution, will not change

a conduct disorder or an episodal attack of any other nature caused by a dysfunction in our autonomic nervous system. The world's position towards such people has been much like that of the attitude of the lady whose husband had the depression or what that of the medical profession would have been a few years ago towards the patient who "lost her legs" In short, that all such behavior was hysterical, unnecessary and foolish and if the offending persons did not stop it and brace up, something which of course they could do if they tried hard enough, they were entirely undeserving of any sympathy or respect

All of us are able to recall to memory the apparently foolish and silly conduct at times of patients which we are still calling hysterical We well remember a patient of ours who started out to die every night about 11 o'clock and she went through the same symptoms of dying night after night In the beginning of these episodal attacks of dying, we had to send for the lady's husband each time who was some distance away

The most striking thing about these attacks was that the experience and memory of previous attacks, while the attack lasted, seemed to be completely blotted out of the patient's consciousness Reasoning with her, calling her attention to the fact that she had been dying every night for the past week and was not dead yet, that her pulse and heart were absolutely normal and she had nothing to cause death was without any effect All that seemed to be left of her horizon of consciousness was her fear and horror of death and the emotional reaction of such fears upon her These dying episodes constituted what might be called her especial disturbance of consciousness We are not all the same Our disturbances of consciousness with their accompanying emotional reactions are quite different.

Let me give you an example of a fair average illustration of the spree man, whose personal pathology does not happen to be dying or losing his legs, but drinking in attacks We select the spree man as simply a type of the many different slips in consciousness in which the autonomic system is intimately involved purely for the reason that at the present time this type is so largely responsible for that very serious state in which society and law and order finds itself in our country because of the turmoil and strife over the liquor question Many of us still are using liquor as an alibi for autonomic

imbalance The universal recognition of that individual called the devil shows how dearly we love alibis

This spree man was above the average intelligence, had attained more than the average success To better show the constitutional and inherited susceptibility of his autonomic system, his father had periodical attacks of asthma, he himself has hay fever and is quite susceptible to hives and bee stings His attacks usually begin about the same time in the afternoon and in much the same way He begins with feeling tired and irritable—general autonomic discomforts and possessed of the idea that a drink would brace him up So far nothing apparently so very abnormal We have all doubtless experienced the same feelings and had the same thought When this patient talked with us he was fully conscious of the ruination of his business, the destruction of his home and the loss of respect which these attacks were bringing him to With a greater fear and horror of his attacks than the patient had of her dying episodes, he exclaimed, "What can I do? I will do anything which you can suggest, anything in my power to stop them"

We said to him, "You should stop and think about all the misery and ruination these attacks have caused you thus far before you take that first drink Haven't your former experiences taught you that you cannot do this? Why do you go deliberately and take that drink which in times past has resulted so disastrously to you? Don't you ever think of the trouble to yourself and the grief and suffering to all those whom you love this first drink is going to cost you?" His answer is well worth remembering "No," he said, "I do not I just go and take it and if I think of anything at all, I think I am all right and I can take it without harm" That part of his consciousness which has to do with his former experiences, with reason, prudence, judgment, sense of obligation, duty, etc., is for the time being gone They make no more impression on him than former experiences did on the patient with the dying episodes The horizon of his consciousness is narrowed down to one single objective and autonomic action is intensified, both in that objective and in its execution which is to drink and drink and drink until he is unable to carry on any longer The patient's wife says she knows when his spells are coming on He is entirely a different man Her "Dr Jekyll" has become a "Mr Hyde" and she also knows when the spell is over and when "Dr

Jekyll" comes back Then he is again the same normally behaving man whom she loved and married

The ardent prohibitionist will say, "Ah ha! It was the accursed and damnable effect of the demon rum" We know better and so do the members of this association who have had the opportunity of much contact with this type of patient We know that in their attacks before they have had enough liquor to affect them in any way, when we attempt to advise and restrain them, they are the meanest, the most unreasonable, irritable and damnable patients with whom we ever have to deal The frank psychotic patient is much easier to manage

We wish to refer to one more case of an episodal nature occurring in the type of individual whose conduct has been and still is inexplicable and incomprehensible to his fellow men

The other day there came up in our Probate Court the case of a young man for examination as to his sanity He was a quiet, nice-looking, apparently intelligent, well-dressed young fellow The charge against him was that of indecent exposure He had been arrested for the same offense on previous occasions but was always warned, lectured and discharged We could easily see why these former dispositions of his case had occurred He presented such a nice appearance, seemed so intelligent and humiliated and disgraced by the charge that one's first impression was how could such an intelligent and nice-appearing young fellow be guilty of such a heinous crime against society

We said to him, "You have been arrested before for the same offense, you have been repeatedly warned in regard to it As you sit there you seem fully cognizant of its enormity Why didn't you think of all these things before you committed the act?" The answer here again was very significant and of somewhat similar character to that of the spree man

It was that "I did not think of any of these things you speak of at the time. Momentarily the act itself was all I thought of Everything else was gone" Again for the space of only a few brief minutes in this case the switching out of the circuit all the higher and finer faculties of brain function took place and for the time being the patient was subjected to the complete domination of a powerful autonomic impulse

We scarcely need to proceed further to express our thought concerning the relationship of the autonomic system to behavior and the importance of it in the problems of mental hygiene. Mental hygiene is primarily a medical question as was and is still physical hygiene. Naturally we need all the help from our associates in other walks of life which we can get to deal wisely with these many, many unfortunate individuals whose names are legion who are so seriously afflicted.

We can imagine now some of our lay associates wondering in their thoughts what we propose to do with such types as those described and not only such temporarily and periodically irresponsible types but also those of a permanent character who are handicapped by inheritance and at birth with such an autonomic imbalance that they are continually from their very cradles to their graves a menace in one way or another to the peace and security of society.

Such individuals are born with such dangerous emotional currents and possess a horizon of consciousness so narrow that their behavior in life is inexplicable, unexplainable to the normal person simply because he is trying to judge them as normal individuals.

If we do not permit science to recognize such people, classify and deal with them accordingly in mental hygiene as it has taught us in physical hygiene through bacteriology and immunology to manage epidemic disease, neither the world's war or education or anything else will save this civilization.

What shall we do with them? That is a great question. We feel sure modern scientific medicine will answer the most important part of it, if given the opportunity in pointing out the causes of the various types of conduct disorders, their fundamental nature, and the best way of controlling them, as it has already done in epidemic disease. We can easily see that education alone is entirely inadequate because of the disturbances in consciousness which are brought about through autonomic imbalance, and all that has been stored up in our higher cortical centres by it is either lost entirely or completely dominated by strong autonomic impulses.

The most serious part of this great question in mental hygiene is not a medical question. It is how long will our philosophers, statesmen, jurists, inventors, theologians, women's organizations, etc.,

persist in trying to solve it upon the basis of philosophic theory and empiricism

When we think of what Aristotle away back four hundred years B C said about the foolish plan in which the people of that time selected their leaders of state and then reflect that we in our time are still choosing them in the same old way, we are able to appreciate more fully the struggles mental hygiene will encounter before its foundation can be built upon the scientific rock.

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Surgery

THE PHRENIC NERVE *

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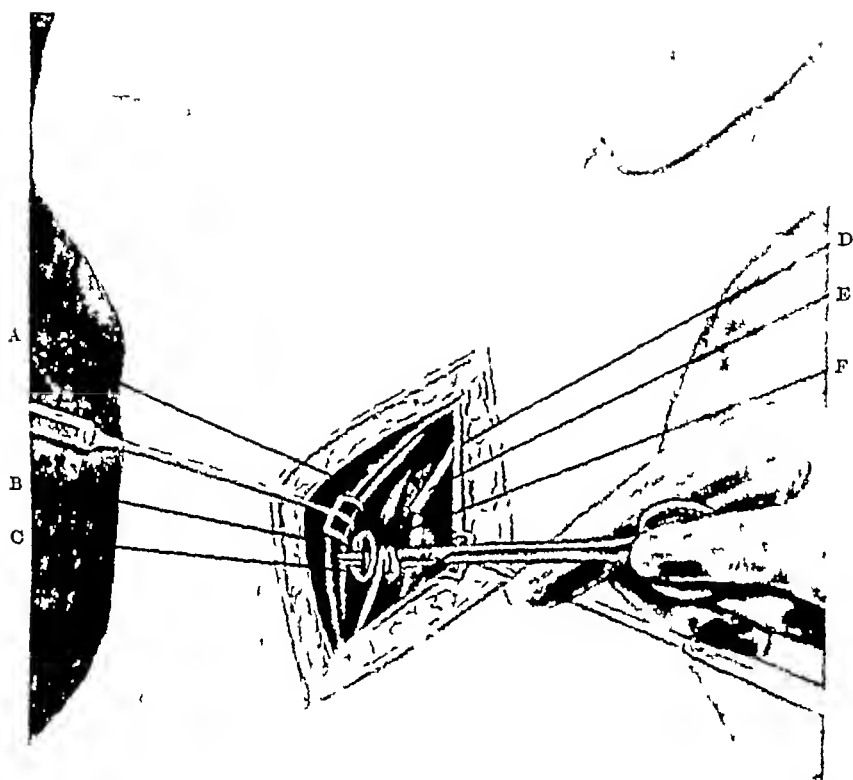
THE phrenic nerve, a mixed nerve originating from the fourth cervical, with branches from the third and fifth, passes downward and forward across the anterior scalene muscle, beneath the cleidomastoid and posterior belly of the omohyoid, transversalis coli artery and subscapular vessels, between the subclavian artery and vein, crosses the internal mammary artery from which it gets its arterial supply and descends in front of the root of the lung between the pericardium and mediastinal pleura to reach the diaphragm which it supplies with motor and sensory fibres. Filaments of the phrenic reach the pericardium, the peritoneal covering of the diaphragm, the falciform ligament of the liver and the suprarenal bodies. A recurrent branch accompanies the inferior vena cava upward to the right auricle.

Capps, who scratched the central portion of the diaphragm in cases of ascites, records that the pain resulting therefrom is referred to the shoulder of the stimulated side (fourth cervical). Cope states that the point of irritation of the diaphragm can be located by this referred pain. Irritation of its anterior part causes pain in the corresponding clavicular or subclavicular region, irritation of the posterior part refers pain to the supraspinous fossa of the same side, irritation of the diaphragmatic dome causes pain in the corresponding acromioclavicular regions and pain felt over both shoulders indicates irritation near the centre of the diaphragm.

Excepting diaphragmatic wounds and hernia it is mainly with

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PLATE I



Avulsion of the phrenic nerve.

A Sternomastoid muscle B Deep fascia C Prevertebral fascia D Platysma muscle
E Phrenic nerve F Anterior scalene muscle

the motor function of the diaphragm that the surgeon is concerned and since this motor function is dominated by the phrenic nerve as shown by immediate palsy and rapid degeneration of the muscle if this nerve be sectioned, such section may seem needful when the action of the muscle becomes abnormal or when conditions are such as to call for a lessening of the alternating conditions of positive and negative pressure within the thoracic cavity

Diaphragmatic contractions account for not more than one-third

FIG. 2.



Phrenic paraneural injection

of the inspired air, hence its complete paralysis may not cause appreciable dyspnoea in conditions of bodily quietude, even though absence of its normal tonicity enables the abdominal organs to encroach to the extent of two to eight centimetres upon the chest cavity

Its central tendon occupies a fairly fixed position, particularly in so far as descent is concerned, and its inspirational function is incident to the fact that by its contraction its dome projecting into the chest is flattened

From the diagnostic standpoint, the referred pain of irritation of the peritoneal and pleural investment of the diaphragm is not without its value. Inflammation or the pressure of supra- or subdiaphragmatic new growths may cause such neck pain, even in the absence of other symptoms. The referred phrenic pain of liver pathology is generally recognized. Irritation of the periphery of the diaphragm is referred to the lower chest and abdomen (intercostals).

The operation of phrenicotomy or avulsion has become fairly common for the relief of two conditions, namely pulmonary tuberculosis and hiccup (Colored Plate 1).

In one-sided basal pulmonary tuberculosis unilateral paralysis of the diaphragm may be indicated as a means of putting the lung of the affected side at rest, nor can it be doubted that thus this end can be partially accomplished.

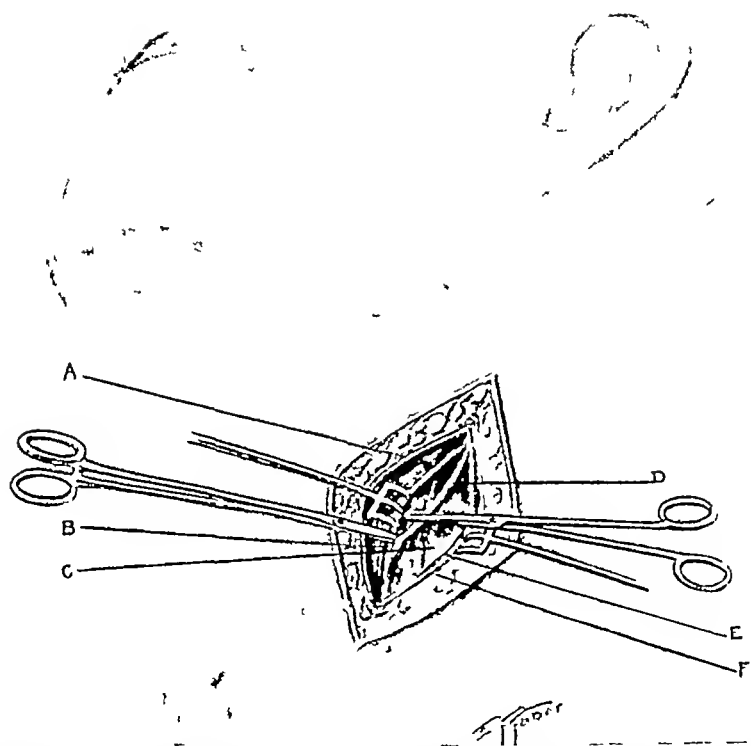
The operations of nerve section or avulsion is performed frequently in association with artificial pneumothorax, under which circumstances there is a marked slowing in the absorption of the injected air.

As to generally successful issues of either the single or combined operation, reports are, on the whole, favorable. The records are not convincing when phrenicotomy is adopted as the sole means of combating pulmonary hæmorrhage. Favorable reports come from surgeons who have used this as a supplement to other measures in the case of lung abscess, bronchiolysis and chronic empyema with sinus formation (bronchoscopic drainage, rib resection, thoracoplasty, etc.) Permanent diaphragmatic palsy by avulsion of the phrenic has, however, been widely recognized as a helpful measure in preparation for thoracoplasty which certain long-standing suppurative lesions require for their cure.

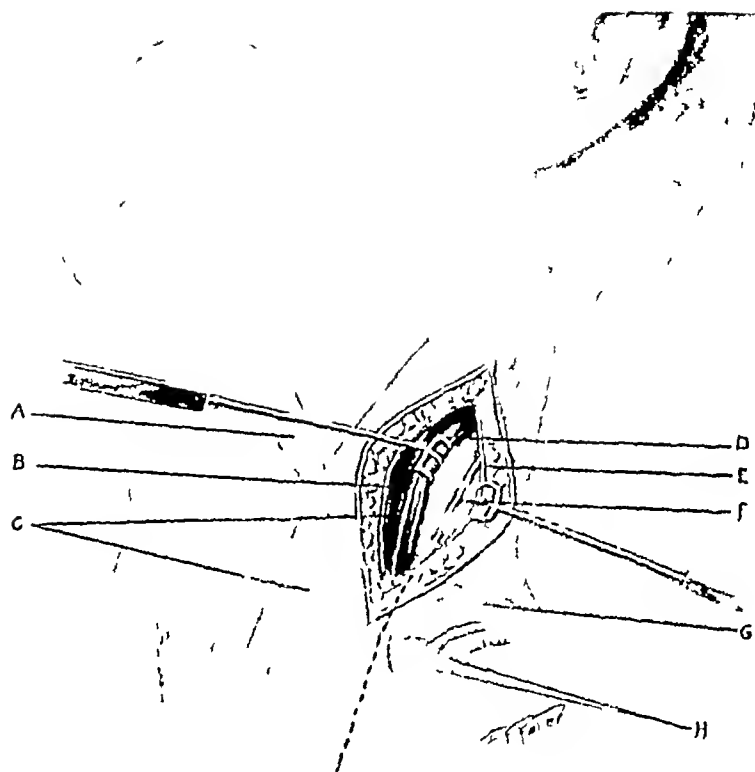
Hiccup, by which is meant sudden involuntary contraction of the diaphragm and simultaneous closure of the laryngeal opening, may be an expression of diaphragmatic irritation as from pleuritis or peritonitis, it is often a manifestation of diaphragmatic resentment against an overfull stomach, particularly if the content be largely alcoholic, it may develop in a recurring persistent form as a symptom of subdiaphragmatic neoplasm (suprarenal, spleen, liver, pancreas).

Starting as a reflex from pressure on the diaphragm it may

FIG 3

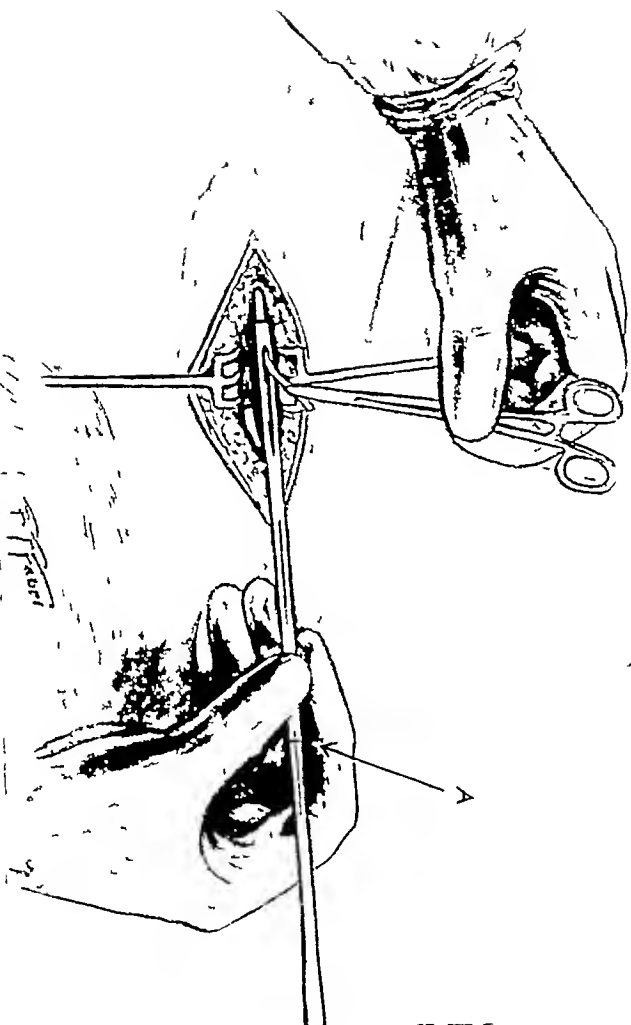


Prevertebral fascia incised phrenic nerve exposed and about to be sectioned (a) Superficial fascia. (b) Sterno-mastoid muscle. (c) Anterior scalene muscle. (d) Phrenic nerve (e) Nerve to subclavius muscle. (f) Platysma muscle



Exposure of the phrenic nerve seen dimly through the prevertebral fascia and being on the anterior scalene muscle (a) Omo hyoid muscle—anterior belly (b) Deep fascia (c), Sternomastoid muscle (d) Prevertebral fascia (e) Platysma muscle (f) Phrenic nerve (g) Omo hyoid muscle—posterior belly (h) Subclavian vessels

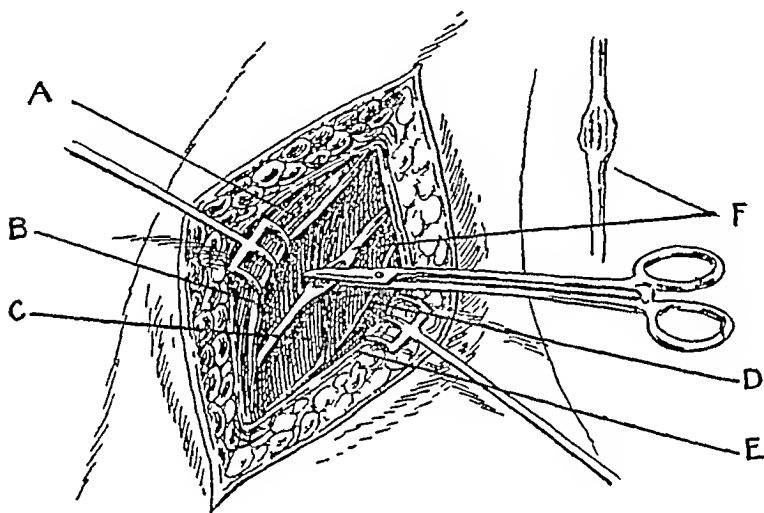
Fig. 6



Freeing nerve of adhesions—nerve threaded through instrument (a) 10 cm mark beyond which instrument should not be passed. Lumen of cylinder $\frac{3}{8}$ of an inch in diameter. Edges thin but dull.

continue persistently or even dangerously as a psychic phenomenon. The latter is its usual ætiology and suggests one or another of a multitude of efficient cures, such as a dash of cold water in the face or against the abdomen, firm pressure over the stomach, tickling the nose and thus substituting a sneeze for the diaphragmatic spasm, the inauguration of a compelling emotion such as fright, perhaps the latter method is the most popular and efficient as evidenced by a soldier's going over the top in the late war against a particu-

FIG. 5



Crushing the phrenic nerve. A, Sternomastoid muscle. B, Deep and prevertebral fascia. C, Anterior scalene muscle. D, Nerve to subclavian muscle. E, Platysma muscle. F, Crushing phrenic nerve and nerve after crushing.

larly well-organized, vicious, noisy and deadly offence, he called to his comrade "Hi, Buddy, say something to frighten me—I've got the hiccups."

Prolonged, firm thumb pressure over the phrenic (several minutes) has seemed to be helpful. If the symptoms persist and rest becomes needful, interruption of the motor impulse may be imperative. This may be accomplished temporarily (for from one to two hours) (Fig. 2) by novocaine nerve block, or by exposure of the nerve and freezing (for from five to six weeks) (Figs. 3 and 4), or by simple section or crushing (for from five to six months) (Fig. 5). The paralysis may be made permanent by avulsion of at least ten

centimetres of the nerve provided the accessory phrenic be removed also (Plate No 1)

Phrenic Nerve Block—Novocaine, 1 per cent solution, five cubic centimetres Needle two inches long, beveled as for lumbar puncture Point of insertion, outer border of sterno-mastoid at the junction of its middle and lower third Direction of thrust, directly backward Depth varying, averaging about one inch Perforation of prevertebral fascia is needful for success Danger, penetration of jugular vein readily recognized by slight suction before making injection. Test of success, if for hiccup, prompt, perhaps only temporary (two hours), relief If for other condition, fluoroscopic examination.

In so far as cosmetic results are concerned a transverse cut is desirable In so far as the surgeon's comfort and assurance of avoiding trouble are of import, the direction of the incision is of little moment provided it be ample

The incision usually advised and practiced is as follows A cut starting two centimetres above the upper border of the clavicle is carried upward along the posterior border of the sterno-mastoid muscle through the deep fascia, exposing the prevertebral fascia beneath which may be seen the phrenic nerve, a glistening cord running downward and inward across the anterior scalene muscle The nerve is isolated from the fascia and if there be doubt as to its identity, tested by electrical or mechanical stimulation The method of avulsion is shown by the illustration. The pull should be slow and steady Experience has shown that at times when the nerve comes away there is bleeding from the small blood vessels which join it in the region of the pericardium

In the hope of lessening the danger of such trauma as may result in opening the mediastinum to a suppurating cavity or tearing blood vessels or other structures glued to the nerve sheath by inflammatory adhesions we have devised the instrument pictured (Fig 6), through which the nerve is threaded and by which a blunt dissection may be carried down beyond the point (from eight to ten centimetres) where an accessory phrenic (25 per cent of cases) joins its main trunk. The nerve having been stripped to the required depth, the instrument is removed and the nerve avulsed by deliberate, steady traction

THE INJECTION TREATMENT OF VARICOSE VEINS

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INTRODUCTION

THE treatment of varicose veins and ulcers was, until recent years, a rather discouraging part of many a doctor's practice. It was impossible to treat the condition by removal of the cause, because its cause has never been determined. Various etiological factors have been suggested but none of them seems to satisfy completely all observers. Those which have gained most prominence include infection, inflammation, endocrine disturbances (especially at the time of puberty, pregnancy and the menopause), a congenital or familial weakness of the veins themselves, and obstructions to the venous flow from mechanical factors.

The exciting factors, as obtained from the patient's history, are most often an occupation requiring the patient to be on the feet for long periods of time, or pregnancy. Approximately 80 per cent of the patients who apply for treatment are women.

SYMPTOMATOLOGY

The symptoms produced by varicose veins are not always in direct relation to the size and extent of the varices

Pain in the lower leg is a common complaint, even in patients with only one or two small varicosities. By causing abnormal and long-continued tension on the terminal nerve filaments of the skin and soft tissues, cramp-like pains often prove severe enough to disable the patient. Patients with larger varicosities usually complain of a heavy and tired feeling of the lower legs. As a rule this is associated with an œdema of the feet and ankles, which is relieved when the pressure in the veins is removed by rest in bed.

A few patients give a history of having had a hæmorrhage from one of the superficial varices which have ruptured from apparently slight trauma

As the disease progresses, regional lymphatic nodes become enlarged and the disease becomes evident as a consequence of venous obstruction.

subcutaneous tissues become infiltrated with firm fibrous tissue, and the skin becomes shiny and pigmented. The same factor accounts for bony and arthritic changes often seen in older patients in the knee and ankle joints.

In approximately 40 per cent of our patients, the chief complaint was of an ulcer of the lower leg. There usually is a history of slight trauma which is given as the exciting cause. Burning pain, often severe enough to prevent sleep, and itching, often associated with an eczematoid condition of the skin, are the outstanding subjective symptoms. The constant ooze from the ulcer site is very distasteful, especially to women patients.

Not a few of our female patients, entirely relieved of symptoms by elastic bandages or stockings, apply for treatment for cosmetic reasons.

DIAGNOSIS

The diagnosis of well-developed varicose veins usually presents little difficulty. The enlarged veins, often extending from the saphenous opening to the feet, may include any or all of the superficial veins of the leg. The distension of the veins is always more marked in the upright position, and the initial examination should always be made with the patient standing.

In those cases where the veins are small and the chief symptom is pain, the differential diagnosis must be from thrombo-angitis-obliterans, intermittent claudication, and Reynaud's disease. The first and last of these present characteristic histories and superficial vascular changes which make the diagnosis evident. In intermittent claudication, the evidences of widespread arteriosclerosis, the history of patient, and usual lack of marked varices aid in the diagnosis.

In many patients the diagnosis must be made from arthritis. Here it must be remembered that varicose veins are often the cause of chronic arthritic changes, and often the obliteration of the varices will in large measure relieve the joint symptoms.

The chief differential diagnosis to be made is that between simple varix and a compensatory varicosity due to a thrombosis of the deep circulation. The patient will often aid the examiner by volunteering the information that rubber stockings and elastic bandages have relieved the symptoms, indicating that when the superficial veins

are compressed the deep veins are competent to take over the venous return

The patients should be carefully questioned as to previous inflammations of the leg, and especially as to the occurrence of a phlebitis. The type most frequently met is the phlegmosia alba dolens (milk leg) of the puerperium. If the patient has had phlebitis, there should be no attempt to obliterate the superficial veins until the deep veins have been proven competent. It is our practice, therefore, to apply a therapeutic test by applying snug elastic bandages to the extremity. If there is an incompetent deep circulation, the patients usually experience no benefit from such treatment and on the contrary complain of more pain and disability. The Trendelenberg test and its modifications have proven of little aid in the diagnosis of deep thrombo-phlebitis.

CONTRA-INDICATIONS FOR THE INJECTION TREATMENT

Having made the diagnosis that the enlarged veins are true varices, the patients should be inspected for contra-indications to injection therapy.

Deep thrombo-phlebitis has already been mentioned as producing a dilatation of superficial veins of a compensatory nature, obliteration of these veins is, therefore, contra-indicated.

The presence of superficial inflammations, skin infections, and especially phlebitis should be considered an absolute contra-indication.

Varicose veins occurring during pregnancy or in the presence of obstructive lesions in the pelvis, often disappear after removal of the obstruction. For this reason, it has been our practice to wait for several weeks after delivery before attempting any injection therapy.

Age in itself is no contra-indication to treatment. Our oldest patient was seventy-four years and he was successfully treated without untoward results. On the other hand, debilitated patients of any age should be treated cautiously if at all.

Cardio-vascular disease, diabetes, and nephritis have been mentioned by many authors as contra-indications to the injection treatment. We have cautiously treated several patients suffering with mild forms of these diseases and have never observed any untoward symp-

toms Our experience would lead us to believe that a careful local examination is in most cases more important than an extensive physical examination

THE TECHNIC OF INJECTION

We feel that the best results are obtained when the vein is injected absolutely free of blood or as nearly so as possible In that case the sclerosing solution comes into contact with the intima of the vein in a concentrated strength and not diluted by the blood Every step in the technic is directed toward obtaining this end

Solutions—In our series we have used mostly the milder sclerosing solutions feeling that equally as good results are obtained by these if care is exercised in emptying the vein previously Glucose in 50 per cent solution was used in most of our early cases This is the least harmful and least toxic of all the solutions suggested for this use, since necrosis almost never follows its escape into the tissues We still use this solution almost exclusively for the injection of small, superficial, thin-walled veins Sodium chloride in 20 per cent solution we have found to be the better sclerosing solution in the larger thick-walled varix. Since the appearance of the paper of Kern & Angle,⁶ we have used a solution of equal parts of 50 per cent glucose and 20 to 30 per cent sodium chloride Since using this combination, we have obtained excellent thrombosis with less violent reactions Occasionally, when we failed to get thrombosis with the above-described solutions, we have used 20 per cent sodium salicylate with good results, although the thrombosis caused the patient a considerable amount of discomfort

Armamentarium—An ordinary 10 cubic centimetre Luer syringe is used in our clinic Larger syringes are bulky and cumbersome and never is there occasion to inject any more than 10 cubic centimetres In selecting a needle we have always used a twenty-six gauge needle, since larger-size needles leave larger holes for the escape of the fluid A short bevel is preferable, because in injecting the small veins with a long beveled needle there is danger of puncturing the vein on the underside in which case some of the solution will escape into the underlying tissues We prefer needles of short lengths, three-fourths to one inch, because they are easier to handle and are not so easily dislodged from the vein when the leg is moved The tourniquets used

are pieces of rubber tubing about eighteen inches in length and sufficiently soft to be tied Elastic web (Ace) Bandage is used following the injection to keep the veins collapsed

Position of the Patient — This is an important factor in emptying the veins We usually use the horizontal position, because in this position the weight of the blood in the trunk and upper extremities has no effect on the pressure in the legs In the sitting and vertical positions, as other authors have recommended, the veins are forced to support a column of blood and it is next to impossible to empty the veins before injecting the solution

Choice of Vein and Its Preparation — After having the patient in the horizontal position for a few minutes to allow the escape of some of the blood, we next select the site to be injected As a general rule, we avoid all thin-walled veins or those in which rupture is imminent The injection of these veins is very apt to be followed by their rupture either externally or subcutaneously with escape, also, of the solution Occasionally, however, it is necessary to inject these veins In this case, we inject from below or approach from the side through the normal skin We also avoid all veins contained within the indurated and fibrotic area about the site of ulcers, because ulcer areas are always potentially, if not actually, infected We prefer to inject the main tributaries, first because following thrombosis here some of the smaller veins very often disappear If they still remain patulous, they can be thrombosed at another sitting McPheeters³ has clearly demonstrated that the circulation in the superficial veins is reversed, i e., from above downwards and from superficial to deep veins In view of this, we very often inject first proximally, so that if after the release of the tourniquets any of the solution escapes it will be toward the ankle in the superficial veins Rarely do we inject the veins of the feet or ankle, because after they have been fibrosed the patients are inconvenienced for a time by pain from the pressure of the shoes After selecting the vein to be injected the site is cleansed thoroughly with 70 per cent alcohol In the small veins, it is very often necessary to have them distended by applying the tourniquets before it is possible to enter the needle into the vein If, however, this does not sufficiently distend the vein to allow the entrance of the needle, we have the patient sit up or even stand When the needle is in the vein, the patient is placed in the horizontal position

The leg is then elevated to empty the vein of blood and the tourniquet applied before beginning the injection of the solution. When an assistant is at hand, it is possible to compress the vein digitally at two points and inject between the fingers, thus holding the solution in the vein injected. The solution is slowly injected into the vein, repeatedly withdrawing the piston to be sure the needle is still within the lumen (Fig 2). The site of injection is carefully observed to note whether or not any of the solution is escaping evi-

FIG. 3

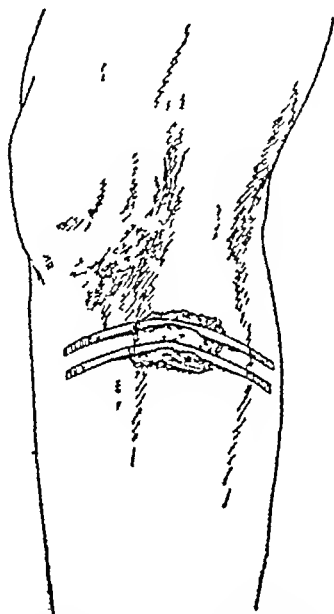


FIG. 3—Gauze compression over injected vein

denced by infiltration of the tissue about the site. After all of the solution is injected, the needle is allowed to remain in the vein for a few minutes, the leg kept quiet and no pressure made on the veins for fear of forcing the solution back alongside of the needle and into the subcutaneous tissue. When the needle is being withdrawn, a small gauze pad is pressed over the injection site and fixed tightly by adhesive strips (Fig 3). Following the withdrawal of the needle and the application of the pad, the patient is kept absolutely quiet, with tourniquets still in place, for fifteen minutes, because as McPheeters^{2 3} has definitely shown there is very little circulation in the veins except on movement of the legs or trunk. We feel that

fifteen minutes is sufficient time to allow the solution to remain in contact with the intima to bring about a mild endo-phlebitis (Sicard) The tourniquets are then removed while the patient is still recumbent and an elastic web bandage (Ace) applied to the leg from ankle to knee to be worn until the patient returns This, we feel, aids in the agglutination of the veins and further prevents reentrance of the blood After the bandage has been snugly applied the patient is allowed to get up and to resume normal activities The patients are warned against the use of all constrictions about the leg Tight garters and bloomer bands are forbidden. Our injections are made twice a week, at intervals of about three days No statement can be made as to the number of injections each patient requires Our practice has been not to inject near the site of a previous injection until the reaction has subsided

REACTIONS AND COMPLICATIONS

The immediate reactions occurring after injection depend on three factors, *viz*, the solution used, whether the injection is entirely into the vein, and, third, whether the solution injected can be held within the vein to be collapsed.

Glucose 50 per cent is the mildest and safest of the solutions we have used Its injection into the vein produces few symptoms, and even when some of it escapes into the soft tissues the only symptom is a short-lived stinging pain at the site of injection A small infiltration results, which is quickly absorbed

The hypertonic salt solutions, even when mixed with glucose, produce much more violent reactions When the injection has been made accurately into a vein, and solution held in the vein by tourniquets or by digital compression above and below the site of injection, the patient may have no symptoms for several minutes after the injection More often, however, especially when the veins are large and the valves of the deep communicating veins are incompetent, the patient experiences an immediate sharp, cramp-like pain in the area between the tourniquets, even after the injection of only one or two cubic centimetres These pains last usually only three or four minutes, but in some cases as long as ten minutes The reaction may be delayed and its severity decreased by having the vein empty before injection and by not overdilating it by too

rapid or too large an injection, thus keeping the sclerosing solution, as much as possible, in the injected vein

The patient should be requested to remain as quiet as possible while this pain is present and for a time (five to ten minutes) afterwards, because any movement of the muscles tends to spread the solution and to increase the cramps. During this period fibrillary twitchings may be palpated in the muscle adjacent to the vein injected, and the patient may describe the course of the veins by the direction of the extent of the pain.

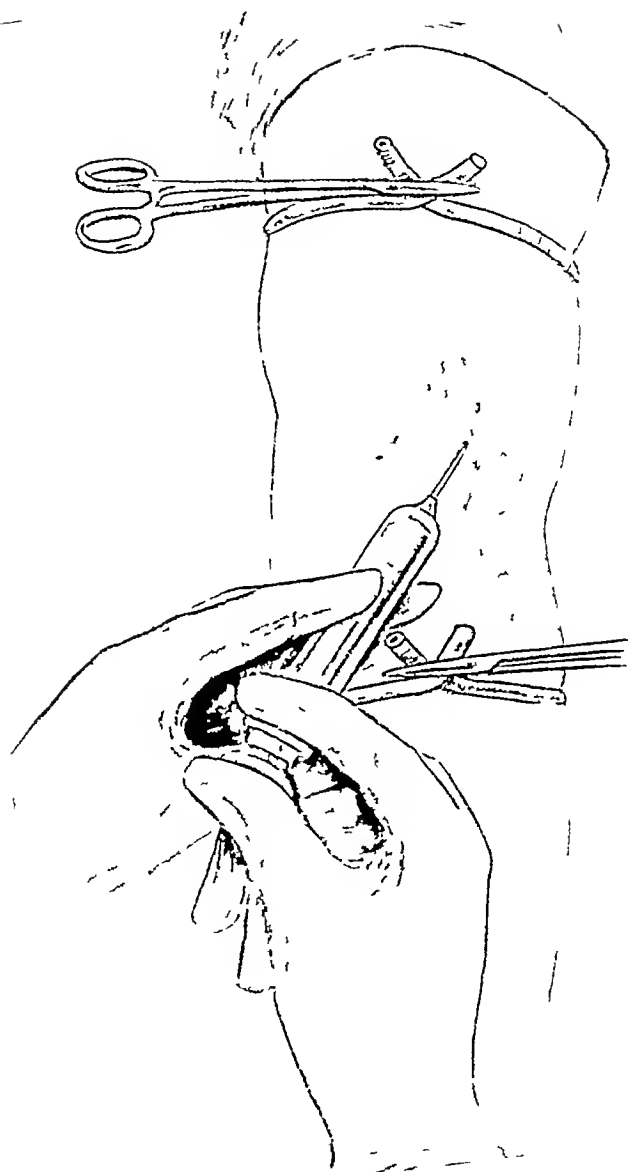
The distal tourniquet should be removed first, followed a few minutes by the proximal one. If this procedure is followed, the extent of the cramp may be materially lessened.

Very marked symptoms are produced if the hypertonic salt solutions escape into the soft tissues. A sharp, stinging pain is experienced at once at the site of injection. Because of this definite location of the pain the operator may distinguish it from the radiating cramp pain due to dissemination of the solution in the veins. The patient should be instructed to describe accurately the location and type of any pain experienced and this information should be a guide as to whether or not to continue the injection.

The operator is usually able to determine whether the injection is into the soft tissues by observation of the site of injection. There is an unusual resistance to the injection, and the tissues about the needle point become blanched. This accident occurs occasionally as a result of movement of the leg after the needle has been inserted into the vein. On one or two such occasions we have left the needle in place and injected through it several cubic centimetres of normal salt solution with good results.

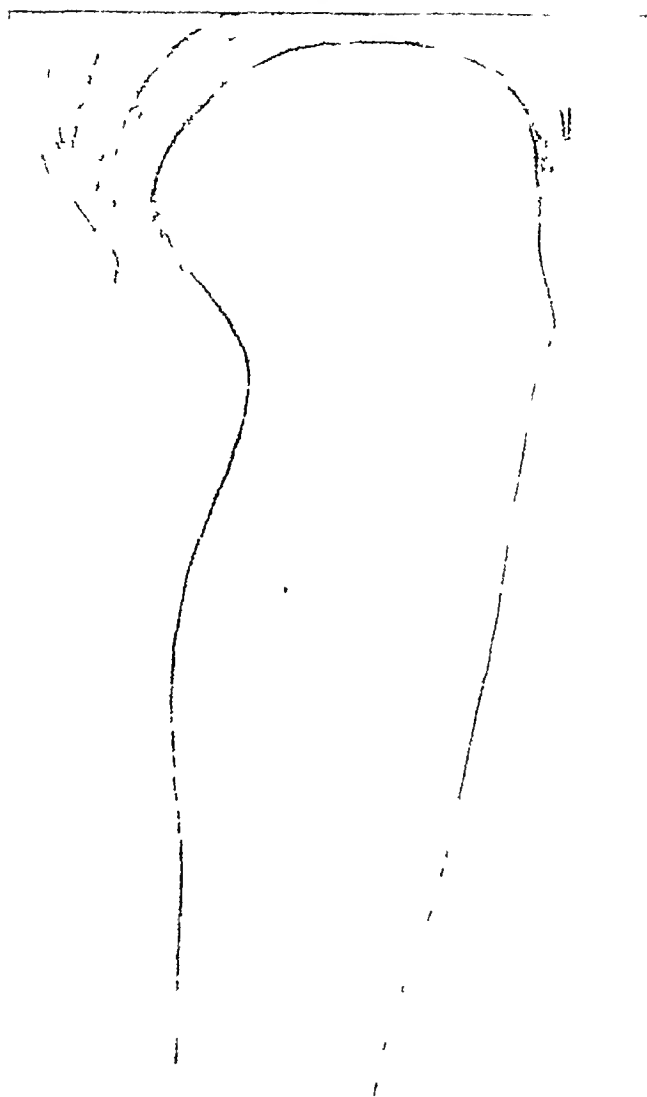
As has already been described, we always attempt to apply tight compression over the point where the needle entered the vein. In spite of these precautions, however, there is at times some escape of the sclerosing fluid through the needle hole. This produces the same results as if the solution were injected directly into the soft tissues. Swelling and tenderness develop within twenty-four hours, the area becomes red and use of the part becomes somewhat painful. If the reaction is small, cold applications are usually of benefit, but if the reaction is extensive, hot applications appear to give the most relief. In most cases, the involved area rapidly decreases in

FIG 2



Method of injecting between tourniquets.

FIG. 4



FF J 0000

Pigmentation along course of vein six weeks after thrombosis by injection

size, becomes less and less tender and painful, finally forming a small indurated, elevated area of deep bluish red color, which gradually disappears

In two cases, in more than five-hundred injections, an ulcer has developed in the centre of this indurated area. One of these followed the injection of 20 per cent sodium chloride, the other was a shallow ulcer occurring after the formation of a bleb in the middle of the affected area after the injection of a 20 per cent sodium salicylate solution. These ulcers thus produced heal slowly and leave a somewhat depressed reddish scar.

Embolism, which was the chief objection raised to the injection treatment of varicose veins, occurs rarely. McPheeters and Rice¹ report 53,000 cases collected from the literature with only four cases of definitely diagnosed pulmonary embolus which proved fatal. They explain this low incidence by the fact that the direction of flow in the varicose veins is toward the periphery and not toward the heart.

The normal, uncomplicated reaction produced after the injection manifests itself in twenty-four to forty-eight hours by a slight redness and tenderness along the treated vein. Palpation of the vein reveals a hard cord-like structure, slightly tender, with some induration about it. This reaction usually disappears by the fifth day, the vein remains hard and gradually decreases in size until it becomes firm cord (Frontispiece).

If the thrombosis produced has been extensive, a definite area of brownish pigmentation can be noted in the skin along the course of the vein (See Fig 4).

Occasionally, there is an extension of the reaction along the course of the vein for several days after the injection. We had one such case in which, during one week, the reaction extended gradually from the knee to the saphenous opening. Needless to say, this patient caused considerable anxiety for a time, but he is now one of our best cases.

RESULTS

Our experience is based on the treatment of seventy-two cases with 510 injections. There have been no fatalities and no cases of embolism. In two patients, necrosis occurred at the site of injection,

one following the use of sodium chloride 20 per cent, and the other following sodium salicylate 20 per cent

Five of our cases had been operated upon previously and these patients responded especially well to the injection treatment.

Usually after the first two or three injections the patients are relieved of most of the subjective symptoms associated with varicose veins. The pains, tired heavy feeling, and swelling of the ankles disappear long before all the veins have been obliterated. In most cases with arthritic changes, marked clinical improvement is early noted. Itching and the eczematous affections of the skin disappear rapidly.

The treatment does not confine the patient to bed, an advantage over the operative method.

Reurrences of varicosities occur, according to Forestier,⁵ in about 15 per cent of cases. These recurrences should be considered as the dilatation of new veins and not as the reappearance of those previously sclerosed. By keeping the patient under observation for a period of six months to a year, these veins may also be sclerosed and the patient completely and permanently cured.

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THE DIAGNOSIS AND TREATMENT OF HERNIA

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INTRODUCTION

THE literature on the subject of hernia is vast. It is so enormous that it is quite impossible for a busy surgeon to keep in touch with all that is written. It is even more difficult and confusing for the general practitioner, who has so little time at his disposal for reading, to keep in touch with modern ideas on this important subject.

It is my intention in this, and the following subject, to outline briefly the salient points in the anatomy and pathology of hernia. Having this knowledge the reader will readily appreciate the ideas to be adopted in the ideal rational operative procedure.

No detailed discussion of operative technic will be undertaken, but practical outlines of pre- and post-operative care will be given, enabling the practitioner to follow with intelligence and understanding the suggestions of the operating surgeon.

HISTORICAL SURVEY

"Rupture" has been recognized from the earliest times in the history of man. A small prehistoric figure exists, showing a primitive truss, apparently made of a skein of wool, restraining an inguinal swelling. Hippocrates, in the fifth century B.C., describes taxis for strangulated hernia. Celsus, writing in Rome in the first century A.D., was particularly interested in umbilical hernias in children. He applied bandages and later described excision, ligation of the sac and suture with linen stitches. Galen, also of Rome, wrote on this subject in the next century. He agreed with Celsus that hernia was due to a "rupture" of the peritoneum.

In the seventh century Paulus Aegineta of Alexandria wrote on "enteroceles" and "bubonocoeles." He taught, however, that there was no breaking, but rather a slow stretching of the peritoneum. In this period there were many herniotomists of note. These

elled from town to town, moving off (perhaps wisely) as soon as they had finished operating. One of these men, Fabricius ab Aqua Pendente, performed 200 operations a year.

In the Arabian school, which next becomes preeminent, Rhazes, in the tenth century, used harp strings for ligatures, and Avicenna described the value of auscultation in the diagnosis of hernia (Watson).

In the Middle Ages in Europe, the lamp of surgery was burning darkly, as was that of all other branches of arts and science. One spark of light shone for a short time in Bologna in the thirteenth century, when a wonderful surgeon, Theodoric, demonstrated that wounds could be made to heal without suppuration. He was, however, condemned as being unorthodox, and asepsis was lost for another 500 years, till the advent of Pasteur and Lister.

In the fourteenth century Guy de Chauliac wrote careful descriptions of the anatomy and on the treatment of hernia. Pierre Franco in 1556 wrote a voluminous book on hernia, in which he described the operation for strangulated hernia. Ambroise Paré operated with success, using his special wire stitch, the *punctum aureum*. In the eighteenth century Littré, Petit, de Gimbernat and Richter made valuable contributions to the knowledge of hernia.

In the nineteenth century Sir Astley Cooper in England and Scarpa in Italy, published beautiful drawings of the hernial regions. Soon after, a new impetus was given to surgery and improved operations were devised. These were introduced into England by Sir Spencer Wells in 1854.

The operation for inguinal hernia was continually improved until Bassini described his operation in 1890, and W. S. Halsted his method, about the same date. The new idea, introduced by these men, was to cure the weak spot in the abdominal wall by stitching together the conjoined tendon to Poupart's ligament. (Fig 1.)

When the operation is completed the immediate anatomical result is ideal. Unfortunately, recent work shows that muscle will not unite to fascia to give a permanent line of union. Operations of the Bassini type must, therefore, be condemned. One or two surgical generations will pass before this error is fully recognized.

Since Bassini's time a large number of surgeons, chiefly American, have published details of newer operative technic. Details of

these will be found in Watson's monograph on hernia or in my own small book on this subject¹

Valuable fresh ideas and brilliant results have followed the work of Gallie and Lemesurier (1921) who are not content with herniotomy alone, *i e*, excision of the sac, but, who repair the weakened abdominal wall with fascial sutures (hernioplasty)

In this proceeding they use living fascial sutures

To sum up the history of hernia operations, three periods may be recognized Herniotomy—from Hippocrates till the time of Bassini, Herniorrhaphy—from Bassini till 1921, Hernioplasty—the modern operation

ANATOMY OF HERNIAL REGIONS

In this article, inguinal and femoral hernias are alone considered Since femoral sacs are now also invariably excised by the inguinal route, and wider dissections are carried out at the time of operation, a practical knowledge of such structures as the deep epigastric vessels, the obliterated hypogastric artery, the perivesical fat and the transversalis fascia, becomes essential

An acquaintance with the embryological development of the hernial regions is as essential to the correct understanding of oblique inguinal hernia, as is the relationship of the development of the gill clefts to harelip

At an early date in the development of the human embryo, a collection of active mesenchyme is found passing from the lower end of the genital gland through the abdominal wall, ending in the genital tubercle This is gubernaculum Later, this structure grows rapidly, spreading in different directions but chiefly down into the scrotum In the normal individual all these strands except the scrotal disappear The scrotal strand pulls down a pouch of peritoneum, the processus vaginalis

By the seventh month of fetal life this process reaches the junction of scrotum and anterior abdominal wall Six weeks later the testis passes out of the abdomen, carrying down a fold of peritoneum with it into the scrotum

Should one of the other gubernacular strands not disappear, but become larger than the scrotal one, then the testis is dragged into

¹ LEWIS, H. K. "Hernia and Hernioplasty," London, 1927

the perineum, to the root of the penis, over the symphysis pubis, to the fossa ovalis or over the inguinal ligament. In this way the various forms of undescended testicle are produced.

Normally the processus vaginalis becomes obliterated as soon as the testis has attained its scrotal position.

In dissections it is possible to find all stages of obliteration or otherwise of this process, from a complete pouch—a vaginal hernia—to fibrous strands or a local cystic enlargement along its course, an “encysted hydrocele of the cord” (Fig 2). In every dissection it is possible to demonstrate the commencement of the pouch—a potential hernial sac.

In about 30 per cent. of all cases the processus vaginalis is even more prominent either on one or both sides. The existence of this potential sac will be shown to be of great practical importance in the pathogenesis of oblique hernia, and in the operative treatment of direct hernia (Fig 3).

Along with either a potential or an actual hydrocele of the cord there may be an excessive growth of the processus vaginalis, throwing the extra peritoneum into folds. The former condition is known as the infantile hernia of Hey, the latter, Cooper’s encysted infantile hernia (Fig 4).

In the female the processus vaginalis becomes the canal of Nuck. The round ligament is attached to the posterior wall of the sac, and is only separated from it with difficulty (Fig 5).

The sac is patent in from 18 to 25 per cent. of female subjects. As in the case of the male, partial occlusion of the canal may occur with either an actual or a potential hydrocele.

Anatomical Relations of the Oblique Sac—The sac, formed as described in the previous paragraphs, leaves the abdomen through the internal abdominal ring. This is a perfectly definite structure, being well delineated by thickened circular fibres of the transversus fascia (Fig 3) and having the following boundaries. Above, the arcuate muscular fibres of the transversus and internal oblique muscles, below, the epigastric vessels covered by Cooper’s “vertical fibres”, medially, the beginning of the conjoined tendon, and laterally, the oblique fibres of the ligamentum inguinal (Poupart) separated by an interval of transversus fascia, over the edge of which

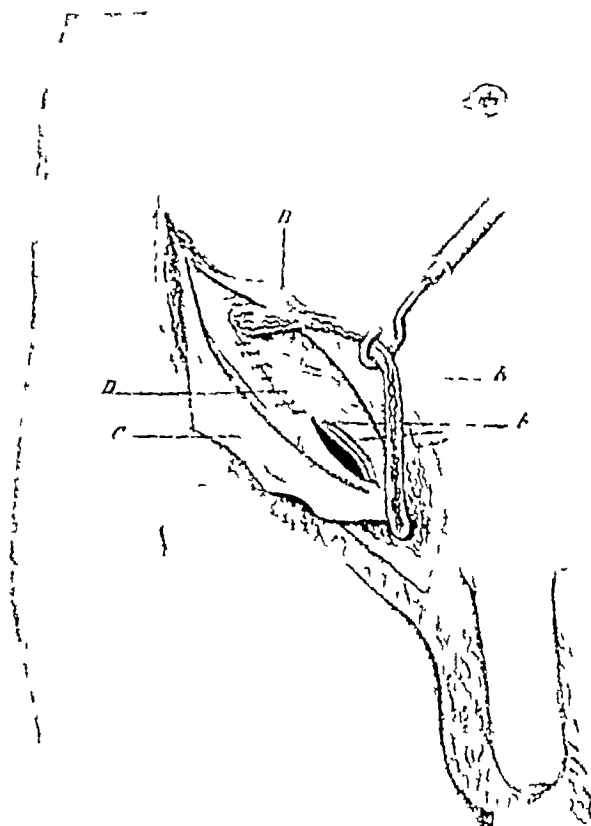
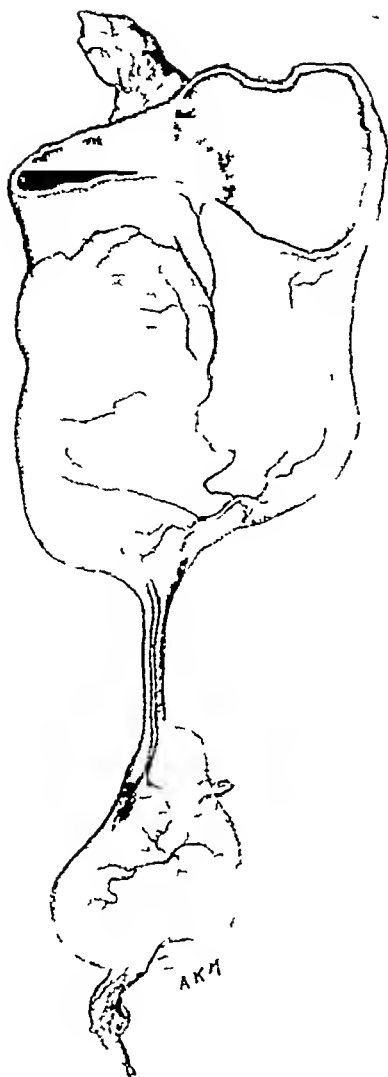


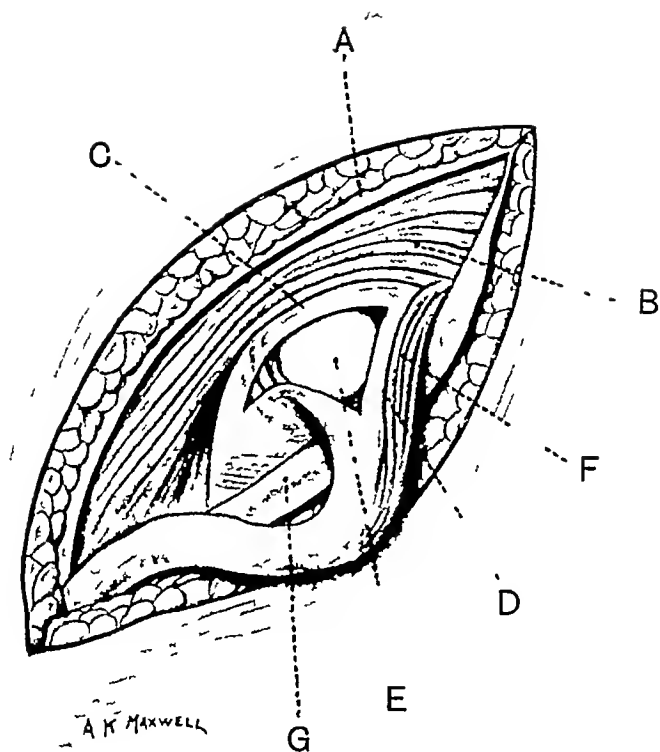
Figure reproduced from Bassini's original paper

FIG. 2



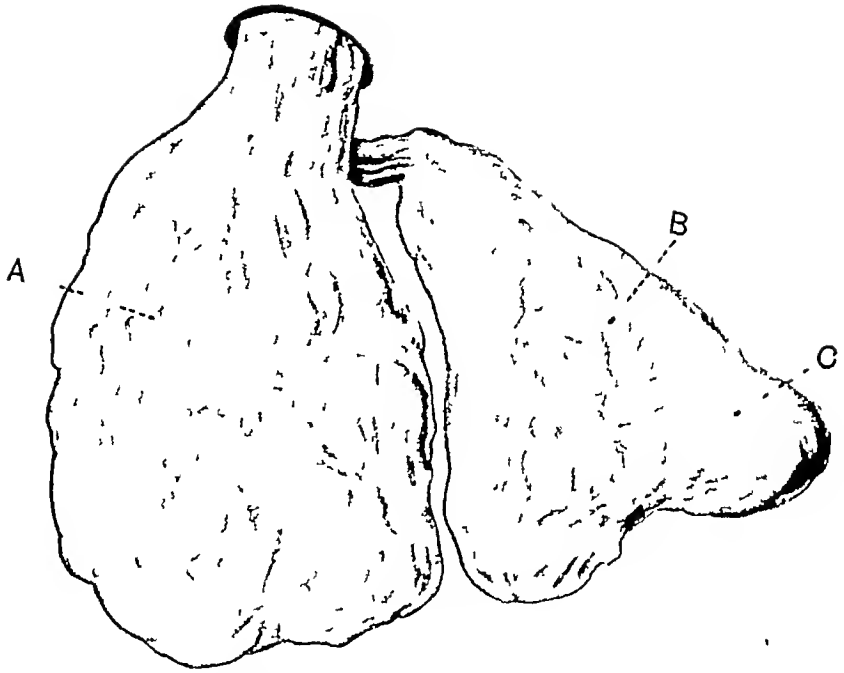
At top of illustration is seen the unobliterated processus vaginalis. Below a fibrous strand represents the partially obliterated portion with a saccular collection of fluid encysted hydrocele of cord.

FIG 3



Potential Sac left oblique Inguinal Hernia (a) External oblique (b) Internal oblique muscle (c) Circular fibres of internal ring (d) Divided infundibuliform fascia (e) Potential sac (f) Cremaster muscle on cord (g) Poupart's ligament

FIG 4



Heig s Infantile Hernia (a) Unobliterated processus vaginalis from an excessive fold of peritoneum (b) Original processus vaginalis closed above empty (c) Testicle from an operation specimen

pass the spermatic vessels and the vas. The cremasteric fibres cover its anterior and outer aspects.

Having appeared through the internal ring the sac proceeds down the cord beneath its coverings. A weak spot appears in the triangular interval below the epigastric vessels. Here a direct hernia makes its appearance either above or in conjunction with an oblique sac (Fig 6).

If this lax tissue be incised two layers may be recognized. First, the transversus fascia, secondly, extravesical fat. The bladder comes into close relationship with this loose fat here and in the course of the operation the obliterated hypogastric artery should be seen as a definite, shining, white strand of fibres.

Femoral Hernia—Proceeding downward from the foregoing dissection, the finger will enter the femoral canal which lies immediately medial to the iliac vein. (Fig 7)

If a sac exists it passes down into the thigh through this opening in Poupart's ligament and appears in the thigh at the saphenous opening, to come forward and turn upward over the inguinal (Poupart's) ligament.

The proximity of the bladder to the neck of the sac, and the laxity of the peritoneum in this region should be noted.

MORBID ANATOMY OF HERNIAL SACS

Reference to Fig 8 will show the appearance of an oblique hernial sac which has been removed by an adequate operation. It is surprising how much lax peritoneum (which forms the mouth) can be removed, even where the hernia is small. Consideration of specimens such as these will show why the older operative methods of removal after torsion or simple ligature of the pedicle are so often doomed to failure.

Inspection of the inner aspect of this part of the sac generally reveals thickenings of the peritoneum. These are the "corns of Villandr " and arise where the peritoneum comes into relation with the epigastric vessels. In the female it is generally necessary to remove a portion of the round ligament with the sac.

The direct sac does not reach so great a size as the oblique and possesses no noteworthy features. A lipoma is generally found in

front of a direct sac, sometimes so large it has to be removed before the inguinal canal can be satisfactorily restored

The co-existence of a direct and an oblique sac must not be forgotten. Such a bilocular sac has been well named a saddle-bag or pantaloonsac. The failure to remove either half is one of the common causes of so called recurrence of the hernia (Fig 9)

Femoral Sacs—Fig 10 is very important. Note the large amount of peritoneum forming the mouth of the sac. There is a uniform fibrous thickening keeping the mouth of the sac open. In cases where the sac is removed from below Poupart's ligament, this patent orifice if left behind invites a recurrence. The drawing also shows a piece removed from the extravescical fat and at the fundus a lipoma. This lipoma precedes the descent of the peritoneal sac into the thigh.

Contents of Hernial Sacs—In addition to small and large bowel other organs may be found as hernial contents. These are the vermiform appendix, tube and ovary, bladder and uterus.

The omentum is probably the commonest occupant of a sac. It frequently becomes adherent to the sac wall even in potential sacs where the patient was not aware of any actual hernia.

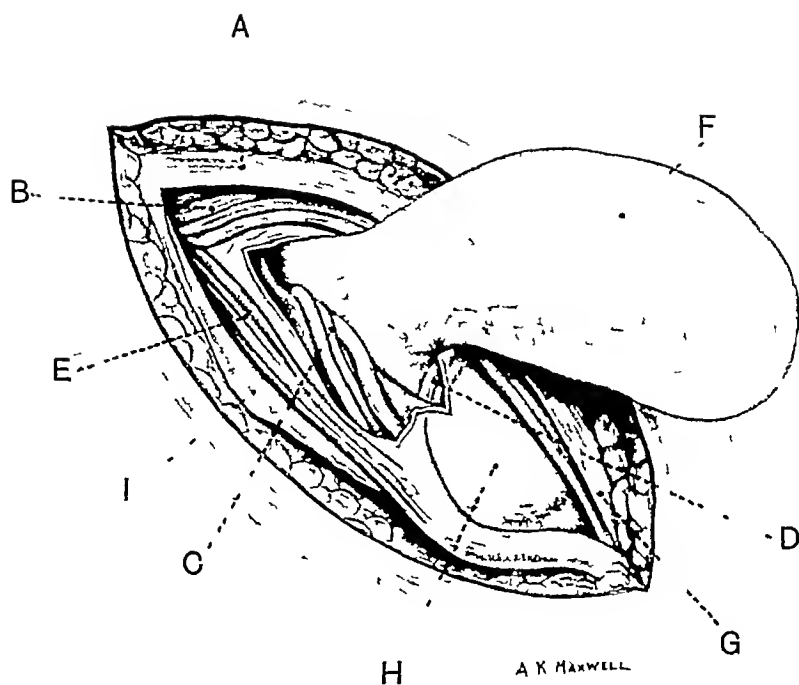
PATHOGENESIS

Oblique Hernia—From preceding remarks it will be seen that a large number of persons possess unobliterated peritoneal processes in the inguinal region, and that all possess sacs of potential hernias, perfectly definite however small. What prevents the entrance of abdominal contents?

The work of Professor Sir Arthur Keith on the sphincter action of the muscles guarding the abdominal ring is well known. When the sphincter reflex becomes weakened, perhaps from a general toxic cause, lack of exercise or physical development of the muscles or from general debility, then sudden strain, or prolonged increase of intra-abdominal tension, as from coughing, drives down abdominal contents. Once the hernia has "come down" growth may be very rapid. There is the well-authenticated case of a Persian camel driver, seen with a small bubonocoele. Six months later, on his return from a desert journey, the sac reached down as far as his knees.

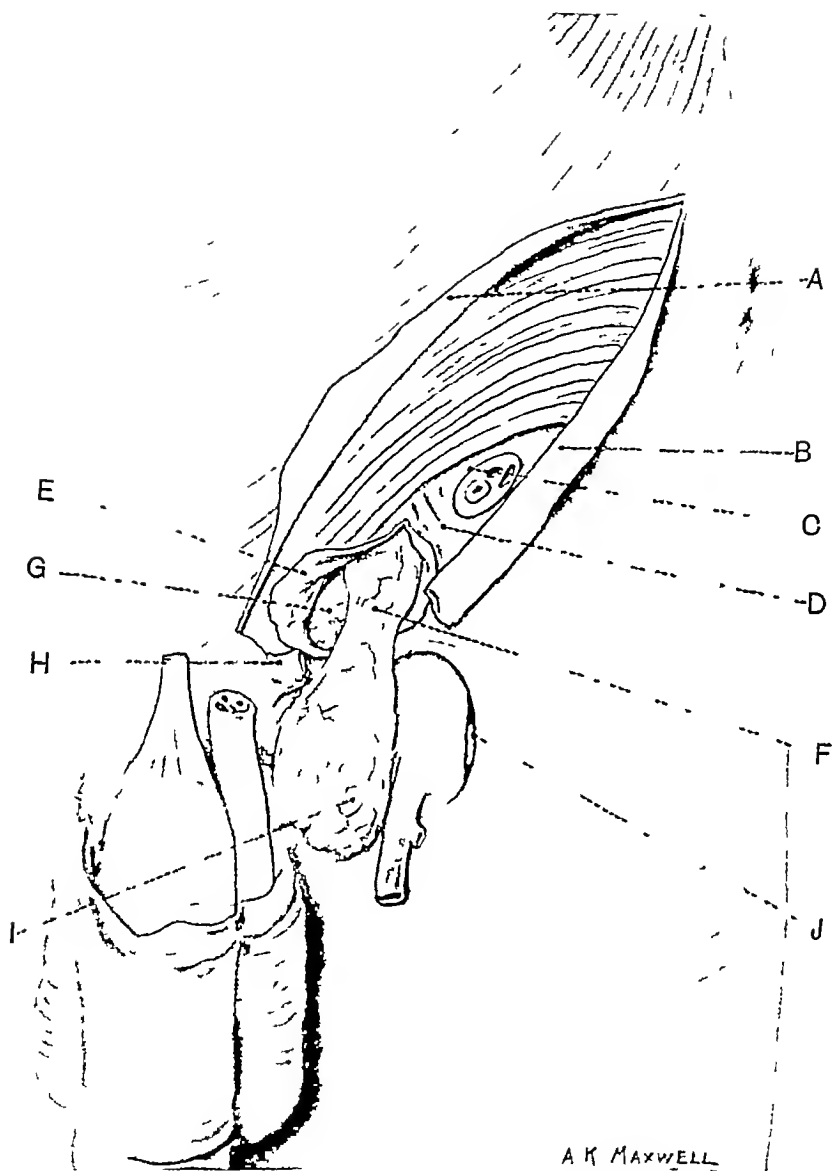
From the practical point of view, it is interesting to note that in cases where the inguinal grip on an invaginating finger has been lost,

FIG 5



Anatomy of oblique Inguinal Hernia (a) External oblique aponeurosis (b) Internal oblique muscle. (c) Vas and vessels crossing outer margin of internal ring. (d) Deep epigastric vessels (e), Cremaster muscle of cord (f) Fundus on sac. (g) Conjoined tendon (h) Undefended spot (site of recurrence) (i) Poupart's ligament.

FIG 6



A K MAXWELL

Anatomy of Femoral Hernia (a) External oblique aponeurosis (b) Poupart's ligament
 (c) Internal ring (cord cut) (d) Fascia over epigastric vessels (e) Fascia transversalis (f)
 Neck of femoral sac. (g) Bladder (h) Gubernaculum transversalis (i) Lat over fundus of
 sac. (j) Saphenous opening

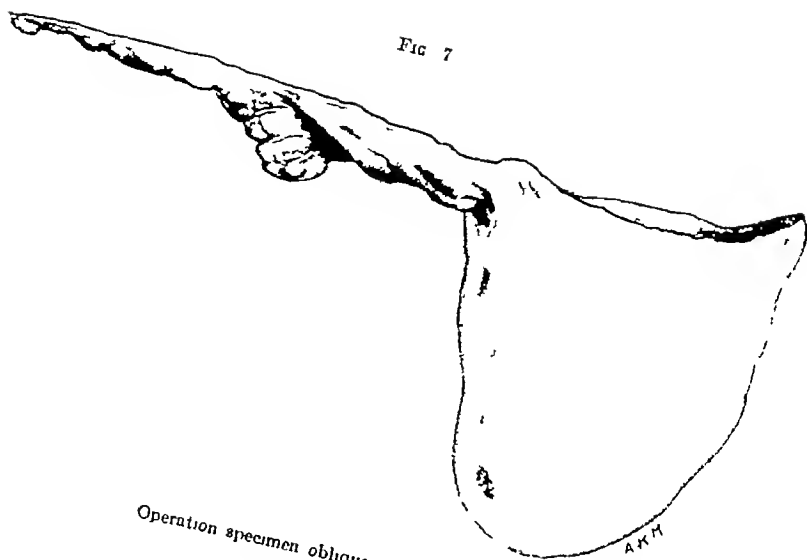
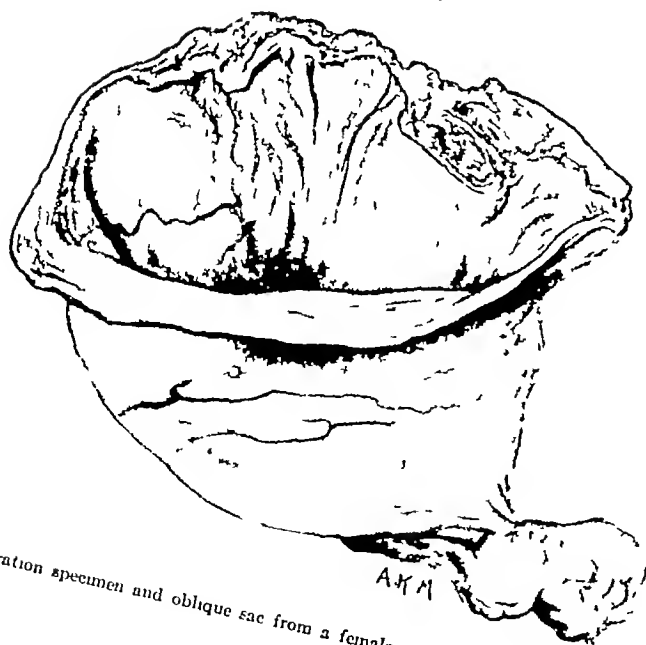


FIG 7

Operation specimen oblique inguinal sac

FIG 8



Operation specimen and oblique sac from a female showing torn ligament

it quickly returns when an adequate operation has been performed, tightening up all the structures concerned in the reflex.

Direct and Femoral Hernias—The congenital theory cannot be advanced as an explanation of the origin of these hernias

As a rule these hernias occur with both advancing years and increase in body weight

A general adiposity or localized lipomatosiis occurs to prepare the way Lack of physical exercise produces loss of muscular tone and laxity of the tissues Increase in intra-abdominal tension as by hard work or the cough of chronic bronchitis, completes the formation of a hernia

I have found direct hernias in patients of twenty years, and a well-developed femoral sac in a little girl of six. In these cases a local lipoma appeared to be the direct predisposing cause of the hernia

SUMMARY

1 The occurrence and treatment of hernia have been known from time immemorial, but rational treatment has only been carried out within the past decade

Operations of the Bassini type are obsolete and of academic interest only

2 Study of the morbid anatomy of excised sacs, demonstrates the necessity for adequate removal of the lax peritoneum round the neck of the sacs This observation specially applies to the case of femoral hernias

3 Since all persons possess either unobliterated sacs or small sacs at the internal ring, the idea of prevention of hernia becomes important

Suitable physical exercises should be advised, to keep up the tone of the abdominal muscles, and general attention be given to hygiene to eliminate any toxic factor which may weaken the inguinal sphincter reflex.

PART II

CLINICAL EXAMINATION

In these busy days, time may be profitably spent in investigating a possible hernia case, by carefully noting the patient's sympto

pointed out long ago by Trousseau, a careful history is often of the greatest value in arriving at a correct diagnosis. Many early cases of hernia present themselves, complaining of vague and indefinite symptoms. Others come under observation for dyspepsia, slight pains or even as acute abdominal cases, where the hernia has been entirely overlooked.

As the hernia increases in size the symptoms are localized to one or other groin and the swelling is noticed. In quite large hernias apart from the local discomfort and inconvenience of the swelling, very little pain is felt, unless omental adhesions exist or incarcerated bowel (non-obstructed) is present. In this article strangulated hernias are not discussed.

In femoral hernia the symptoms are generally slight, the small swelling in stout individuals being even unnoticed. If the patient complains of severe pain radiating down the inner side of the thigh an obturator hernia should be suspected.

As in all other surgical conditions, before a diagnosis is arrived at and advice as to treatment is given, careful consideration must be given to the patient's general condition.

If large numbers of hernia cases are seen, cards may be prepared with headings as below. On the back of the card are outline diagrams to be filled in with the physical signs and diagnosis.

HERNIA CARD

Date		Serial No
Name	Age	Sex
Address		
Occupation		
Present complaint		
Pain		
Swelling		
Duration		
Past history		
Childhood		
Truss	Operation	
Reputed cause of present hernia		
Cough	Strain	Accident
General health		
Weight lost	Weight increased	
Cough	Other illnesses	
Remarks		

PHYSICAL EXAMINATION

If the patient is too fat to allow of ready palpation of the pubic spine, the bony point may be easily found by following up the tense tendon of the adductor longus muscle

DIFFERENTIAL DIAGNOSIS

In arriving at a diagnosis it is advisable to eliminate first the rarer conditions. The following is a practical classification, largely taken from Leigh Watson's monograph

I *A If the Swelling Is Reducible and Extends Into the Scrotum*—The diagnosis lies between varicocele, congenital hydrocele and hernia and large labial veins

(a) A varicocele in the male is commoner on the left side, has a characteristic feel, is non-translucent and does not fill the inguinal canal

(b) A congenital hydrocele occurs in infancy, fluctuates, is translucent and does not disappear on lying down

(c) The distended labial veins of pregnancy may simulate a hernia

B *If the Swelling Extends Into the Scrotum or Labium and Is Irreducible*—In the male, differential diagnosis lies between a hydrocele of the tunica vaginalis, an enlarged testicle and a hæmatocele

In a hydrocele the upper end may be defined and the fingers made to meet above it. The possibility of the co-existence of a hernia must be recognized. Bearing in mind the other two possible errors, their diagnosis should present no difficulties

A large hydrocele of the canal of Nuck must be mentioned in the female. Fig 15 shows a myxo-sarcoma of the labium which was sent into the hospital to be operated on for hernia. Recently another rare condition was sent to me for operation as a lobial hernia, where the swelling was a neurofibroma occurring in von Recklinghausen's disease. Small neuromata existed elsewhere, which the doctor had missed

II *A. If the Inguinal Swelling Does Not Extend Into the Scrotum or Labium and Is Reducible*—(a) In the male a funicular hydrocele of the cord may be present. It is translucent, is very rare and a hernia generally co-exists

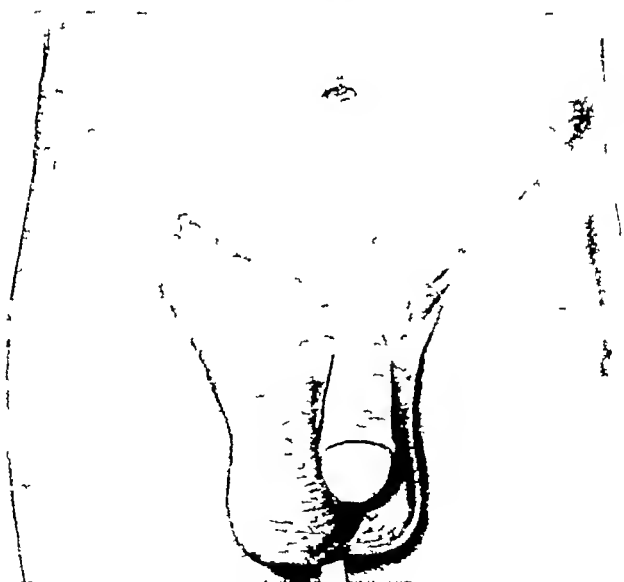
(b) In the female a similar condition of the canal of Nuck may be present.

FIG. 11.



Malignant Bulgings.

FIG. 12.



Oblique Inguinal Hernia

B If the Bubonocoele Is Irreducible—In the male the hernia may be simulated by an undescended testis, an encysted hydrocele or a lipoma of the cord

In the female a funicular hydrocele of the canal of Nuck, a lipoma or tumor of the round ligament must be considered

Two other conditions may effect either sex inguinal adenitis and a psoas abscess In both these cases the canal is empty and further examination completes the diagnosis

DIFFERENTIAL DIAGNOSIS OF FEMORAL HERNIA

It may be difficult in some cases to decide between inguinal and femoral Leigh Watson lays down in these cases, "When the diagnosis between inguinal and femoral hernia is difficult or impossible, the hernia is usually femoral"

A. Reducible Femoral Hernia—(a) A varicose saphenous vein may show a globular enlargement at the saphenous opening The swelling disappears when the patient lies down and gives a characteristic thrill on coughing

(b) A psoas abscess may enter the thigh through the femoral canal, but the rest of the swelling can always be felt in the iliac fossa

(c) *Obturator hernia* This is rare and produces a typical pain felt along the obturator nerve The pain may be increased on vaginal examination

B Irreducible Femoral Hernia—(a) *Femoral adenitis* Several enlarged glands are usually present The possibility of co-existing hernia must always be born in mind, and no operation undertaken lightly unless the operator is prepared to deal with a hernia at the same time

(b) *Femoral lipoma* A lipoma generally exists in this situation together with a hernia and should not be removed without recognition of this possibility

METHODS OF TREATMENT

Non-operative Treatment—We have already seen that in the earliest days of Man, primitive attempts were made to restrain the hernia with trusses In the present enlightened and humane days, however, when operative treatment gives such brilliant results in selected expert hands, it is no longer justifiable to condemn a

patient to the mental and physical torture of continually wearing a truss. A few exceptions may possibly exist, as when the patient is in the last stages of phthisis or some other incurable disease.

In many cases I have found the last few years a man of seventy or even eighty years of age have been rendered happy and comfortable because both patient and surgeon were willing to undertake the risk of operation.

Under the heading of non-operative treatment, the prevention of hernia may be more profitably considered. It was shown in the first part of this article that all of us possess inguinal sacs and potential hernias. Wise and discrete development of the abdominal muscles and general attention to personal hygiene will help to prevent the development of hernia.

When a man comes to me with a sagging abdominal wall and lax hernial orifices, I encourage him to tone up his muscles with exercises, if necessary reducing his weight by diet.

As an aid to memory in tightening up the abdomen I tell the patient to transfer his watch or wallet from the accustomed right or left pocket as the case may be. Then whenever he feels in vain in the usual place, he remembers to contract his abdominal muscles.

Operative Treatment—Hernia operations are often looked upon as being suitable practice for junior surgeons and as a legitimate operative field for doctors who do not have many surgical opportunities.

These reasons largely account for the unsatisfactory results obtained, and the unwillingness of the public to submit to operation. A hernia operation is a major operation requiring for its ultimate success, special knowledge, interest and skill on the part of the operating surgeon.

For this reason a surgeon with modern ideas should be chosen, one who is familiar with recent work and methods and one who believes in and practices hernioplasty.

The age at which operation may be carried out is not important. In my own practice I prefer to wait till an infant is at least twelve months old, since the risk of strangulation is slight. The operation can be performed earlier and I have successfully operated where the infant has been two or three weeks old only.

At the other extreme of life I do not refuse operation merely

on account of age I have successfully carried out a deliberate hernioplasty on a man of 82, even though he was feeble and suffering from auricular fibrillation of the heart

I do not propose entering into the details of operative technique in this article

My own method of hernioplasty was published in 1927¹ and has proved eminently satisfactory in my series of nearly 400 cases

Since so many hernias are bilateral or may subsequently become so, it is wiser to ask the surgeon to operate both sides at the same time This procedure can usually be completed within the hour

PRE-OPERATIVE PREPARATIONS

The less anxious and exhausting the preparation to which the patient is subjected the better If bronchitis is present it is essential to delay the operation If he is physically fit, the patient should enter the hospital at least twelve hours before the operation He need not be violently purged, a mild laxative is sufficient Care should be paid to deal with oral sepsis, especially if a general anæsthetic is to be given It is important to see that the patient is made thoroughly comfortable and kept cheerful

Perfect attention to detailed preparation and sterilization of the operation area is essential Otherwise a troublesome, prolonged convalescence may ensue, owing to mild sepsis

POST-OPERATIVE CARE

The most likely post-operative complications are retention of urine, traumatic shock, ileus paralyticus, thrombosis and embolism, pneumonia and surgical neurasthenia Sepsis in any form should not occur

Retention of Urine — This trouble should not happen with good nursing If it does, it may mean the surgeon has interfered in some way with the bladder wall, if he has not done a good operation Use the catheter only if all other means fail and wait longer in women than in men

Traumatic Shock — Now that the cause and prevention of shock is better understood it is rare to meet with the condition after operation Gas and oxygen with or without ether, local or spinal anæ-

¹ "Hernia and Hernioplasty" Lewis & Co, London, 1927

thesia is safe Warmth, gentleness in operating and control of hæmorrhage will prevent shock If shock should occur in a feeble subject, exhibition of warmth and fluids will generally give a good result Do not poison the patient by giving all sorts of hypodermic injections

Ileus Paralyticus—After the reduction of a large amount of intestine into the abdomen, in some cases ileus results It is a rare but fatal condition. If simple measures such as aperients, lavage, or pituitrin fail, enterostomy is immediately indicated.

Thrombosis and Embolism—This is occasionally a disappointing end to an otherwise satisfactory operation I believe that mild sepsis, heavy handling of tissues and undue delay in getting the patient up again after operation, are the causative factors

I never use retractors in this operation and after hernioplasty start early movements, allowing my patient up after the fifth day In people of 70, I encourage the use of a bedside chair after the second day

Pneumonia—Should not occur if a suitable anæsthetic has been given and nursing care is adequate

Surgical Neurasthenia—Patients who convalesce too rapidly and go back to their usual occupations too soon are apt to become neurasthenic later on.

General Post-operative Management—Apart from avoiding and treating possible complications routine after-care is as follows

Bandage I use an ordinary many-tail bandage and even in men do not add a spica of the thigh A sound operation is not followed by a scrotal hæmatoma

Bowels and Diet The bowels may be opened in twenty-four hours, after which the patient is allowed within reason any food he fancies

Exercise After the fourth day I encourage the patient to contract his abdominal muscles He is told to "tighten up" whenever he hears the clock strike and then after two to three days to perform regular movements The sphincter grip is thus found to come back quickly

Getting Up The patient should be encouraged to leave his bed from the fifth to the seventh day After the eighth day he may walk and generally is well able to leave the hospital from the twelfth to fourteenth day

Games and Work The advantage of hernioplasty is that it is not only safer but more advisable to start muscular exertion far sooner than after the ordinary Bassini operation. I expect men to play golf a month after operation, and always try to persuade those who perform heavy muscular work as carpenters, laborers, etc., to resume their occupations at the end of four weeks.

Reëxamination Patients should be seen every three months for two years. If they are sound then they will probably remain so.

Results My own series of hernioplasties is too small upon which to base final opinions. In some thirty cases of femoral and twenty-five direct I have had no recurrences, after three years. In over 300 oblique inguinal cases I have had three recurrences, under 1 per cent.

Study of larger series of cases show that recurrence is very rare in children. In adults the results naturally depend largely on the operator.²

Oblique inguinal hernia	3- 8 per cent recurrence
Direct	10-25 per cent. recurrence
Femoral	9-14 per cent. recurrence

I maintain that universal adoption of hernioplasty will materially improve these results.

SUMMARY OF ARTICLE II

In making a differential diagnosis eliminate rare conditions before deciding upon the diagnosis of a common condition.

Non-operative treatment, except in very exceptional instances, is unjustifiable and obsolete.

Operative treatment should be carried out only by those possessing special skill and enjoying constant opportunities for surgical practice in hernia cases.

A form of hernioplasty is the operation of choice, the older Bassini types of operation should be regarded as of academic interest only.

Operation results are good. Mortality is practically nil and recurrence rate for all oblique inguinal hernias should be well under 5 per cent.

² These figures are quoted from the Table by Erdman *Association of Surgery*, vol 77, p 101, 1923.

THE HISTORY OF THORACIC SURGERY *

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The field of thoracic surgery has rapidly expanded in America since the organization of the American Association for Thoracic Surgery twelve years ago. Although the youngest of specialties, it has made tremendous strides both in Europe and in America and an enormous amount of research work is being done in the great medical centres of these countries. It is hoped that this symposium and the exchange of ideas among the delegates here will be productive of wide-spread interest in the subject of chest surgery in all countries bordering upon the Pacific.

The real foundation for chest surgery was laid by Laennec,¹ who first correlated the clinical symptoms of diseases affecting the lungs and pleura, with the pathologic anatomy as revealed by post-mortem examinations. His masterpiece, "*de l'Auscultation Médiate*," published in 1819, was the beginning of scientific as against empirical medicine. In this amazing book, published more than one hundred years ago, are precise and original descriptions of clinical symptoms and post-mortem appearances as true now as when they were written. Indeed, no modern treatise can equal them for accuracy and clearness. Many of his observations refer to conditions up to that time unknown or little understood. Except the diagnostic aid afforded by the X-ray, little has been added to our knowledge of the diagnosis and post-mortem appearances of pulmonary tuberculosis, pneumonia, pulmonary apoplexy or infarct, empyema, œdema, gangrene, bronchiectasis, hydro- and pneumothorax since the days of Laennec. About the only pathologic condition of the lung which Laennec failed to discern was massive collapse.

While Laennec's fame rests chiefly upon his discovery of the stethoscope and the physical signs of pulmonary disease, he was a master pathologist. He performed as many as two-hundred post-

* Chairman's address before Section on Thoracic Surgery and Bronchoscopy at Pan Pacific Surgical Conference held at Honolulu, August 17, 1929

mortems upon patients whom he had personally examined during life and who had suffered from tuberculosis or pneumonia. Not only did he draw vivid and accurate pictures of signs and symptoms in disease, but he carried this gift of description to the post-mortem room and showed that it was possible to predict during life the post-mortem findings. What he accomplished in twenty-five years seems incredible when we remember that he was an invalid most of his life, suffering from asthma, angina, insomnia and later from tuberculosis, of which he died. Harassed by ill health and family worries, traduced and ridiculed by many of his medical contemporaries, this frail young man with no one to teach him, guided only by his genius and upheld by his indomitable spirit, laid the foundations not alone of thoracic surgery but of scientific medicine. As thoracic surgeons, let us do homage to this man who paved the way for modern lung surgery in his studies of pathologic anatomy.

The earliest recorded operations upon the chest were those for the drainage of empyema. Adhesions between the visceral and parietal pleuræ rendered thoracotomy a comparatively simple and safe procedure and obviated the dangers of lung collapse which for so long deterred surgeons from opening the chest cavity.

Dr Friedrich Mosler,² director of the medical clinic at Greifswald, Germany, in 1883 collected all of the noteworthy literature upon the subject of lung surgery up to the publication of his book. This interesting monograph of less than one hundred pages purports to review all of the worthwhile literature upon the subject up to that time.

At the conclusion of his address before the Second Congress for International Medicine at Wiesbaden, April 20, 1883, Mosler said: "When from our present standpoint I glance back over the past ten years, it appears to me that within this period the problem of lung surgery has been somewhat advanced. After the expansion of another decennium what position will it have?" He cites references found in the works of Hippocrates, in which lung abscess following pneumonia was evacuated through an opening in the pleura made by an incision or by the cauterization. The following case references are found in Mosler's book:

Schenk in 1584 relates a case of lung abscess which, after the application of fomentations, plasters and caustics ruptured and

found its way out through the chest wall. He also reports the spontaneous rupture of a pleural exudate beneath the breast and he concluded from his observations in such cases that in the future they should be treated surgically

In 1664 the Latin authors, Willis and Baglini, advocated the drainage of lung abscesses and incurable pleural exudates by means of an intercostal incision Purmann, a German writer, in 1662 advocated drainage of blood following wounds of the chest and also in cases of empyema In 1670, Bligny, a French author, described a lung infection following a sabie wound which healed spontaneously In 1726, E Berry, an Irish surgeon, advocated the direct drainage of tuberculous cavities and reported several cases in which he had performed this operation (*Treatise on Consumption of the Lungs*, p 366, Dublin, 1726) In 1769, S Sharpe (*Treatise on the Operations of Surgery*, p 128, London, 1769) advocated direct incision into cavities with a lancet after adhesions had formed Panteau, a Frenchman, (*Mémorial sur la Phthisie*, 1783), demonstrated the safety of draining lung abscesses by direct incision through lung tissue or by means of a trocar In 1797, Doctor Faye (Richerand *Nosographie Chirurgicale*, 8 Edit vol 4, p 194, Paris, 1812) operated upon a lung abscess after adhesions had formed between the visceral and costal pleuræ

From 1800 to 1873 there were many surgeons in Europe and England who advocated drainage for empyema and lung abscess and the principle of drainage in these conditions, after the formation of adhesions, became well established Mosler then reviews at length ten contributions to lung surgery between the years 1873 and 1883, bringing the subject up to the date of his monograph

(1) Vidal "Ueber Multiple Punktiformige Kauterisation bei der Behandlung der Krankheiten der Respirations Organe," *L'Union Méd*, No 97, 1882, *Centralblatt für Klin Medizin*, No 19, 1882 He advocated the drainage of lung abscess by means of punctures made with a cautery at white heat

(2) Koch, W "Ueber die Veränderungen, welche gewisse Mechanische und Chemische Reize in Lungen Parenchym Hervorufen," (V Langenbeck, *Archiv für Klin Chirurgie*, vol 15, No 3, *Berliner Klinische Wochenschrift*, No 41, p 490, 1873) Experimental injections into the parenchyma of the lungs of rabbits and

dogs Koch thought this might produce scar tissue which would aid in the healing of lung lesions which were not too far advanced

(3) Fraenke, Eugene "Experimentelle Untersuchungen uber den Einfluss von Injektion Medikamentöser Substanzen in das Lungengewebe," *Deutsche Med Wochenschrift*, No 4, 1882 Experimental injection of the lungs of rabbits with solutions of carbolic acid The pathologic anatomy was studied *post mortem*

(4) Jablonowsky, Friedrich "Experimentelle Untersuchungen uber Lungeninjektion," Inaugural Dissertation, Greifswald, 1882 Injections of carbolic acid, 15 per cent to 5 per cent Solutions of iodine and emulsions of iodoform and eucalyptus oil were injected Following injections of carbolic acid of weak solution there was no change in the clinical picture Following very strong injections, firm adhesions formed between pleura and lung and there was widespread scar tissue in the lung with narrowing of the alveoli Much the same result followed injections of Lugol's solution After injection of iodoform, abscesses of lung developed Croupous pneumonia after injection of eucalyptus oil Conclusions Only iodine and carbolic acid are permissible They produce connective tissue in the lung and favor healing

(5) Mosler, Friedrich "Zur Lokalen Behandlung der Lungen Kavernen, Address in Section for Int Med Naturalists and Physicians, Wiesbaden, September 23, 1873 Advocated local treatment of bronchiectasis and lung abscesses through a cannula introduced into the cavity through the thoracic wall Reports several cases improved after injection of two cubic centimetres of potassium permanganate solution

(6) Pepper, William Local Treatment of Pulmonary Cavities by Injections through Chest Wall, *Am Jour Med Sci*, October, 1874 Injections of solution of iodine in selected cases

(7) Fenger, Christian, and Hollister, J H Opening and Drainage of Cavities in the Lungs, *Am Jour Med Sci*, 1881 Reports several cases of lung abscess drained by incision and exposure of cavity

(8) Koch, William "Zur Lungen Chirurgie," Dritte Mittheilung, *Deutsche Medizinische Wochenschrift*, No 32, 1882 Report of two cases of chronic bronchiectatic cavities with gangrene drained by puncture with thermocautery

(9) Bull, Edward *Christiana med Archives*, vol 13, No 17, 1881 Report of two cases of circumscribed lung gangrene treated surgically Drainage and irrigation with carbolic acid solution Bull records seventeen cases of lung abscess and bronchiectasis treated by incisions and drainage

1	Mosler and Huter	1873	Bronchiectasis
2	R L Sutton	1873	Abscess
3	Mosler and Huter	1875	Bronchiectasis
4	Radek	1878	Abscess
5	Cayley and Lawson	1879	Gangrene
6	Sedgwick	1879	Abscess
7	C S Smith	1880	Gangrene
8	Fenger and Hollister	1881	Ecchinococcus and Gangrene
9	E Bull	1881	Gangrene
10	G Finne	1881	Abscess
11	Albert	1881	Bronchiectasis
12	O Summerfeldt	1882	Tuberculous Cavity
13	H Payne	1882	Bronchiectasis and Gangrene
14	W Koch	1882	Bronchiectasis and Gangrene
15	Mosler and Vogt	1882	Ecchinococcus
16	Mosler and Vogt	1882	Bronchiectasis and Gangrene
17	O F Williams	1882	Bronchiectasis

(10) Experimente über Lungenresektion

(a) Dr Th Gluck, Assistant am Königl Klin zu Berlin "Experimenteller Beitrag zur Frage der Lungen Extirpation," *Berliner Klinische Wochenschrift*, No 44, p 645, 1881 Reports twenty operations on dogs and rabbits

(b) Dr Hans Schmidt, Assistant, Augusta Hospital, Berlin Resection of Apex of Lung Lung tissue ligated with double catgut Eight operations on dogs

(c) Doctor Block, Danzig Experimental resection of lungs in rabbits, dogs and pigs

The following is a translation of Mosler's paper, numbered five in this collection of ten articles This paper was published in the *Berliner Klinische Wochenschrift*, October 27, 1873

Mosler's first attempt to introduce remedies through the chest wall into cavities was in a patient fifty-one years of age in the last stages of phthisis. He was a laborer who had a right-sided pneumonia in 1869. He later developed tuberculosis and had several attacks of hæmoptysis. He was greatly emaciated. There was a cavity in the right apex superficial and reaching down to the fourth rib. November 1, 1872, Doctor Mosler inserted a large cannula through the second intercostal space, six centimetres from right border of sternum. Through this was injected twenty cubic centimetres of a dilute solution of potassium permanganate. The cannula was allowed to remain *in situ* and on three successive days the syringe was attached and a similar quantity of solution injected. The cannula became occluded on the fourth day and was withdrawn. The patient suffered no inconvenience.

In February, 1873, the experiment was repeated in a left-sided bronchiectatic cavity with fetid secretion. After five injections there was so much improvement that Doctor Mosler said "I feel justified in repeating the experiment in another way, in order to give the secretion free exit and escape" (This was probably the first direct drainage of a bronchiectatic cavity.) The patient, forty-nine years of age, had been treated for five years for a bronchiectatic cavity of the right upper lobe. He had several attacks of hæmoptysis and frequent attacks of fever. He was emaciated and had amyloid kidneys. July 2, 1873, an incision was made along the upper border of the third rib through the skin and intercostal muscles. The visceral and parietal pleura were firmly adherent. The cavity was opened by forcing through a pair of forceps. Pus and air escaped. There was no hæmorrhage. A large silver drainage tube was introduced. There was free drainage of pus through the tube, requiring frequent changes of dressing. There was a slight hæmorrhage on one occasion. The cavity was treated by injections of weak carbolic acid and tincture of iodine. There was temporary improvement with a less offensive pus, but patient did not improve greatly. October 5, 1873, he died. Post-mortem revealed a large cavity involving most of the upper lobe. The walls of the cavity showed some prominences consisting of fresh granulations, otherwise it was smooth. Mosler's conclusion was merely that local treatment of lung cavities can be effected. The value of the operation was questionable in his mind.

On March 14, 1874, (*Philadelphia Med Times*,) William Pepper reported three cases treated by injections through the chest wall and remarked that this method of treatment would probably find its best field in non-tuberculous cavities. He used Lugol's solution as injection material.

Dr Jas H Hutchinson, (*Philadelphia Med Times*, May 30, 1874,) condemned the method of injection into lung cavities and showed that it was not a novel idea, having been tried at various times in the history of medicine. He believed that injections lighted up inflammation and did harm. Hutchinson concludes with a quotation from Dr Hughes Bennett who thinks that the operative interference in phthisis has been "what an intelligent consideration of the pathology of the disease might have anticipated, a uniform failure." In 1881 Dr Christian Fenger and Dr J H Hollister read a paper before the Minnesota State Medical Society on "*The Opening and Drainage of Cavities in the Lungs*." They referred to Mosler's experiment and pointed out that while it had not accomplished results in phthisis, it had demonstrated the possibility of drainage in lung cavities and encouraged others to try it in other infections less destructive of lung tissue and more amenable to treatment, *e g*, abscesses and pulmonary gangrene. Cavities arising from acute pathologic processes are not progressive as is tuberculosis and are not necessarily fatal. Such cavities, where drained either by spontaneous rupture or artificially, tend to heal. Death often results in such abscesses from toxæmia and exhaustion before spontaneous emptying, hence an effort to anticipate nature and drain them is a logical and justifiable procedure. Up to that time, 1881, but six cases had been so treated. Only one of those was successful. They then report the cases operated upon up to that time.

CASE I—(Radek, 1878 *Centralblatt für Chirurgie*, No 44, p 750, 1878.) A man forty four years of age with two large fluctuating abscesses in the region of the right nipple. Pressure over these caused cough and expectoration of pus. It was thought to be an empyema which had broken into the lung. An incision was made and a quart of pus evacuated. The patient died twenty four hours after operation. It proved to be, at autopsy, a very large lung abscess.

CASE II—(R. S Sutton, Pittsburgh, Pa, 1870 *Chicago Medical Record*, p 112, March 5, 1881.) Bavarian, aged thirty four years. Large abscess in lower left lung. Incision through sixth intercostal space, drainage and washing with carbolyzed water. Improvement for twenty six days, sudden death on thirty first day. Cause not given. This case demonstrated clearly the feasibility of opening

and draining a cavity in the lung and relieving the system of pus and gangrenous material

CASE III—(W Douglass Powell and R. W Lyall, London, 1879, *Lancet*, vol 2, p 12, 1880) Multiple abscesses in lower lobe of right lung subsequent to bronchitis and pneumonia Drainage through incision in intercostal space, mid scapular line Improvement, drainage insufficient Pleuro pneumonia on opposite side Death fifty days after operation This patient had several cavities in the lower lobe There was insufficient drainage either by the bronchus or through the small tube introduced through a trocar He died of pneumonia on opposite side, probably due to aspiration of septic material from the affected lung

CASE IV—(Williams, London, 1879 *Lancet*, vol 2, p 12, 1880) Tapping of a bronchiectatic cavity with an aspirating needle A circumscribed empyema followed this aspiration, probably due to infection along the course of the aspirating needle This was also tapped and drained

CASE V—(Solomon Charles Smith, Halifax, England, 1879 *Lancet*, vol 2, p 86, 1880) Gangrenous cavity in middle lobe of right lung, following croupous pneumonia Insufficient drainage through bronchi Incision in region of scapular angle Drainage with injections of carbolized water Improvement for a week, less fetor and expectoration Death twelve days after operation This gangrenous abscess followed lobar pneumonia There was a rapid destruction of lung tissue followed by fetid expectoration The cavity was located by an aspirating needle, a cannula was then inserted Guided by this, a knife was thrust between the ribs, the opening enlarged by forceps and a small drainage tube inserted Carbolic acid solution was injected through the tube This caused coughing, followed by the evacuation of a pint of fetid pus Decided improvement for one week Cavity was syphoned and irrigated frequently Fetid discharge continued Eight days after operation, discharge lessened, expectoration increased The wound began to slough, gangrenous shreds were expelled through the tube Patient grew rapidly weaker, dyspnoea and cyanotic Died on ninth day No autopsy This was probably the first case of pulmonary gangrene, following pneumonia, to be drained by direct surgical attack Drainage was insufficient and did not permit all gangrenous material to escape Had it been adequate, the patient might have been saved.

CASE VI—(Christian Fenger, Chicago, *Chicago Medical Review*, Vol 1st, p 57, 1881) Large fetid abscess cavity in middle lobe of right lung caused by suppuration around an echinococcus cyst of twelve years' standing Fetid expectoration, insufficient drainage through bronchus Diffuse bronchitis in rest of right lung Fever, emaciation and collapse Aspiration Incision in third intercostal space on anterior surface two inches to the right of sternum, digital exploration Counter opening in fifth intercostal space, anterior axillary line Removal of cyst through anterior opening Drainage with large tube, carbolic acid irrigation Cessation of fetor and expectoration Wound closed in six weeks Seventh week broncho pneumonia of right lung, purulent bronchitis of both right and left lungs lasting four weeks Perfect recovery

In this case, probably for the first time Doctor Fenger was bold enough to extend the operation sufficiently to explore the cavity with the finger, remove the cyst and establish thorough drainage Similar cases of parasitic infection of the lung were reported in Ziemssen's

Encyclopedia, (Parasites of the Lung, vol 5, p 462) Fenger discusses abscesses of the lung from the following standpoints. (1) Indications for operation, (2) the operation, (3) after treatment

(1) For the first time he clearly outlines the indications for surgical treatment in lung abscess. He thinks that operation should not be advised until the patient has been given a good chance for spontaneous recovery. If, after communication with a bronchus has been established, the cavity constantly refills, if the fever persists and patient is growing progressively worse—in short, when there is every indication that spontaneous recovery is improbable—direct surgical drainage is indicated. The cavity should be accessible and there should be adhesions between visceral and parietal pleura.

(2) In operating, Fenger advises the opening be made at the most accessible point. Then locate lowest point in cavity and establish counter drainage. Gangrenous pieces of lung should be removed. Pieces the size of a walnut may be found (*Rokitansky Pathological Anatomy, Sydenham Society's Edition, vol 4, p 96*). A case in point is reported by Wagner (*Berliner Klinische Wochenschrift, p 511, September 6, 1880*). Fenger advises soft tubes for drainage. Hard tubes or metal tubes may cause hæmorrhage from pressure.

(3) In after treatment, drainage should be continued until cavity is well compressed, otherwise patient is liable to aspirate septic material from cavity, which may cause diffuse bronchitis or broncho-pneumonia. Fenger concludes with a plea for further trial of this new procedure, although the cases that need it are few.

The fear of asphyxiation and lung collapse when the chest was opened long deterred surgeons from invading this field. In the latter part of the nineteenth century, Fell,^{3, 4} O'Dyer and Matas demonstrated the possibility of maintaining respiration artificially by rhythmically forcing air into the lungs. About the same time Saucubrich^{5, 6} built a negative pressure chamber and showed the possibility of maintaining life with the pleural cavity opened under reduced atmospheric pressure. These experiments soon led to the construction of a positive pressure cabinet in which the chest was opened under the usual atmospheric pressure, while the head was in a chamber in which the pressure had been increased. Experimental work by S. J. Robinson^{7, 8} further demonstrated the possibility of operating upon dogs under positive pressure. About the same time,

Dr Willy Meyer^{9, 10} constructed a cabinet which permitted the alteration of the pressure in either the head or thorax compartment of a double chamber. He performed a number of operations in this ingenious apparatus and showed the feasibility of opening the chest widely without interfering with respiration. These positive and negative operating chambers served a purpose in the development of chest surgery, but they were too cumbersome and complicated to be practical.

The next step in the progress of chest surgery was the discovery by Meltzer and Auer¹¹ that positive pressure could be maintained in the lungs by means of tracheal insufflation. A little later Meltzer¹² showed that the simple procedure of intrapharyngeal insufflation could be substituted for the more difficult tracheal procedure. The last step in the simplification of chest surgery was the discovery that simple gas oxygen anaesthesia, administered through a tightly fitting mask, can be so regulated as to render thoracotomy a safe procedure. Thus by successive steps a safe and simple method has been evolved for overcoming the fear of pneumothorax and lung collapse which had so long haunted the minds and stayed the hands of the boldest surgeons in attacking the thoracic viscera.

Another fear, the supposed susceptibility of the pleura to infection, was largely dissipated during the World War, when army surgeons were forced to operate upon so many chest injuries. The pleura was found to be almost as resistant to bacterial infection as the peritoneum. It was also found that the presence of pneumothorax greatly lessened the resistance of the pleura to infection. The principles discovered during the World War have been carried over into civil life and have given a great stimulus to chest surgery.

In 1887 Forlanini¹³ published his studies on the vital capacity of the lungs and in 1894¹⁴ he advocated the use of artificial pneumothorax as a treatment for pulmonary tuberculosis. In numerous contributions to German and Italian literature, he demonstrated the value of artificial lung collapse in the healing of tuberculous cavities and gave detailed reports of cases to substantiate his claim. (See translation at conclusion of this paper.)

In 1898, shortly after Forlanini reported his first cases treated by artificial pneumothorax, Dr John B. Murphy¹⁵ read a paper before the Denver meeting of the American Medical Association,

advocating compression of the lung in tuberculosis by the injection of nitrogen gas into the pleural cavity. He reported several cases treated by this method. Internists and phthisiologists were slow to adopt the treatment and it almost fell into disuse until its revival and general adoption about ten years ago.

Murphy, in his oration on Surgery in which he advocated artificial pneumothorax, also covered the entire field of lung surgery up to 1897. He gives an exhaustive review of the literature up to that time and tabulates practically all reported cases of operation upon lung abscess, bronchiectasis, gangrene of the lung, tumors, cysts and tuberculous cavities. Doctor Murphy should be credited with pioneer work in surgery of the lung as well as in other fields of surgery which he illuminated by his genius. In the oration on Surgery cited above, he reports one of the earliest thoracoplasties done for compression of a tuberculous cavity. This operation done on January 8th, 1898, was a modified Estlander. A U-shaped incision was made over the second and third ribs. These were resected, the parietal pleura freed and pressure made over the cavity. Complete recovery ensued. His work in this field was antedated by de Cereville, 1885, Quincke, 1888 and Spengler, 1890.

As early as 1907, Friedrich¹⁶ performed an extrapleural thoracoplasty at the insistence of Brauer, an internist, and other European surgeons, notably Sauerbruch,¹⁷ Wilms¹⁸ and Brauer,¹⁹ by somewhat different methods, attempted surgical collapse of the lung by removing the chest wall, but the operation gained little favor and less than one hundred thoracoplasties had been reported up to 1918.

With the exception of these sporadic attempts, chest surgery was practically at a standstill until the beginning of the World War. This great conflict with its vast toll of chest injuries gave a great stimulus to this branch of surgery. It was found that the chest cavity could be widely opened with safety, foreign bodies removed, sections of injured lung and even whole lobes removed successfully. The experiences of the war in this field emboldened surgeons and many of the lessons learned were carried over into peace times and applied to the problems of civil surgery. Graham²⁰ in several valuable contributions to lung surgery has added much to our knowledge of vital capacity, the treatment of empyema and of lung abscess.

Pari passu with the development of technique have grown methods

of diagnosis. The X-ray and opaque media for the visualization of lung pathology have rendered surgical attack rational and accurate. The bronchoscope and the thoroscope have also contributed much to our knowledge and surgical therapy. So rapid has been the expansion in chest surgery in the past ten years, that it would be impossible even to tabulate the operations done for the various lesions, but it may now be said with confidence that this field is well established and fertile for future development.

The chief thoracic conditions now amenable to surgery are

- 1 All forms of pleural infection.
- 2 All types of pulmonary suppuration
- 3 Tumors of the thoracic wall and viscera, except carcinoma
- 4 Properly selected cases of pulmonary tuberculosis
- 5 Chest injuries
- 6 Certain lesions of the pericardium and heart

Translation of Forlanini's Original Contribution on Artificial Pneumothorax in Pulmonary Tuberculosis (*Gazzetta Medica di Torino*, No 20, May 17, 1894)

We often find in medical literature independent contributions tending to confirm the generally accepted opinion that pulmonary phthisis is nothing else but real tuberculosis. Some among the most recent publications deserve and receive more consideration for the reason that while recognizing the unquestionable fact of microbic association with the process, they also assign due importance to pathologic factors other than the bacillus.

I hold, and have expressed for a long time, a similar opinion only more radical. To me the destruction of the pulmonary tissue, which automatically is the culminating and most characteristic fact of phthisis, is not the result of involution of the tubercular product but must be attributed almost exclusively to secondary and associated products. If these products which, like those of the bacillus, may be found in all other tissues of the body, determine the characteristic destruction of the lung, which is observed nowhere else in the organism, this is due to the fact that there exist in the lung certain functional peculiarities of a strictly mechanical nature which are observed in no other organs. Whenever these functional peculiarities

can be controlled, no matter how, the process is checked and the illness may be cured

At the time I was pondering over these facts, the well known thesis of Doctor Toussaint of Paris appeared, reporting a considerable number of cases of pulmonary phthisis, unexpectedly improved and some cured by the occurrence of pneumothorax. A pneumothorax and likewise a pleuritic effusion checked those strictly mechanical processes in the functioning of the lung to which I have just referred. Similar and specific cases were reported later and I observed some myself. I am presenting microscopic sections of a lung in one such case.

This was a tubercular patient who for two years was greatly benefited, obtaining a relative recovery in one lung by the pneumothorax, but who died of phthisis from progressive involvement of the other lung. The sections show the affected part converted into scar tissue, a closed net work of compact connective-tissue bundles, distinct from the vessels, from the bronchi and from the pleuræ and in them lie small areas, as if imprisoned in large connective tissue capsules, of old necrotic foci and even fairly well-preserved fragments of lung.

About ten years ago I proposed to produce artificial pneumothorax in phthisis. I have now carried out my plan and I will now refer to its outcome. I have divided my observation into two parts. The first includes the history of two tuberculous cured by the conservation of a pneumothorax which was followed by empyema. The second concerns the first experiments with artificial pneumothorax.

CASE I—Disease began prior to 1888. Very serious generalization, apical lesion in right lung with small cavities, abundant bacilli in the sputum, phthisical fever, progressive emaciation, in short, the syndrome of far-advanced phthisis. In the spring of 1888, spontaneous pneumothorax developed, followed by empyema. Then followed progressive improvement with remarkable subsidence of symptoms. Nearly a year later, in April, 1889, with suffocation threatening, the empyema was drained. There were two litres of fluid. A month later it was again drained and three litres withdrawn. In July, I was consulted as to the advisability of a third thoracocentesis. The patient had a normal temperature, cough was slight, sputum insignificant and void of bacilli after several examinations. There was a large effusion in the right pleural cavity, the apex beat of the heart was at the sixth interspace in the mid axillary line, the diaphragm was pushed downward on the right, the liver was forced to the left against the spleen. There were no signs of apical lesions in either right or left lung. The general condition was satis-

factory Although the dyspnœa was alarming, I insisted that the exudate be conserved In August, I noticed the first signs of diminution of the exudate This progressed slowly but steadily until 1891 In these two years the symptoms of phthisis entirely disappeared and there was a continuous disappearance of the symptoms resulting from the pressure of the exudate The general condition of the patient so improved that he was able to follow his habitual occupation Among other things, he traveled all over Italy and abroad. In the summer of 1891 alarming gastric disorders appeared, alarming because I believe them to be due to traction on the ventricle from progressive contraction of the right lung Finally in September, while in the country following a dietetic disorder, the patient died in a few hours I had not seen the patient, who had no further need of my services, for several months and, therefore, I can only make conjectures as to the cause of death. A most plausible cause of which examples have been recorded in medical literature, is that acute gastric dilatation followed by intoxication had set in, produced by dietetic errors and favored by interference with the motor function of the ventricle stretched and pinioned to the right side of the chest At any rate, it was proved that the symptoms of pulmonary phthisis, already fully developed in its original form, were mitigated by the pneumothorax, then the disease was arrested and for the past two years had disappeared entirely

The second case is a better illustration.

CASE II—Miss X, was taken sick in the winter of 1884 Both apices were affected and the illness continued for two years, slowly progressing with the common characteristics of phthisis The examination of the sputum left no doubt In the spring of 1886, a right pneumothorax and then a pleuritic exudate appeared and slowly increased. The patient was afebrile and the exudate was not withdrawn until October of that year, on account of dyspnœa Two weeks later it was again taken out and found purulent. The exudate reaccumulated. In July, 1887, it was again alarming and I was called to decide upon the advisability of withdrawing it. I found a rather large, left-sided exudate The apex beat of the heart was in the right anterior axillary line The dome of the diaphragm was pushed downward and to the left and could be felt under the costal arch All over the left side were the classical physical signs of a collection of fluid, on the right side those of limited apical lesion There were bacilli in the sputum, cyanosis, dyspnœa on the slightest movement, there was no fever, digestive apparatus and general condition, good I decided that the exudate should be undisturbed and sent the patient out in the country There the exudate increased and one night when dyspnœa seemed unbearable, the local doctor withdrew the fluid in an emergency The exudate formed a third time It was at its highest level in the autumn. I advised that it be maintained. At the end of 1888, about two years after the pneumothorax appeared, the exudate began to disappear General condition was excellent, cough disappeared, no sputum, slight dullness over the right side with harsh breathing were the only signs left of the right apical lesion. The dyspnœa is tolerable and allows the patient to perform her usual occupation, climb stairs, go outside, etc

Improvement proceeded slowly but surely and in the winter of 1890, three years later, it was doubtful whether an exudate still existed or if only a greatly thickened pleura She considered herself cured and has fully recovered her normal activities There was no sign whatever of the old bacillary lesion At

this time, in February 1890, she suffered an attack of febrile influenza which kept her in bed about fifteen days. The right lung was affected by a bad, widely spread, bronchial catarrh and the left lung by a light catarrh. Everything resolved satisfactorily. I saw the patient only a few days ago. During these past four years her health has continuously improved. The examination of the thorax shows a large pleuritic pseudo-membrane, extending also over the heart, which is almost in normal position. The left half of the thorax is somewhat smaller than the right, but it is as mobile as the other half. On auscultation the breath sounds are harsh, loud with a distinct bronchial character. No disorder of circulation. No sign, direct or indirect, of the old bronchial lesion. General conditions, objective and subjective, excellent from every angle. During last August the patient was on a mountain excursion of thirty two kilometres on foot, at altitudes varying from 3000 to 5500 feet and every winter she takes active part in night dancing affairs, with the untiring strength of a young lady possessing exuberant health.

If in the case I have just revealed, it is proper to talk about the cure of phthisis, the cure went on coincident with the pneumothorax in 1886. This cure may be recognized as having started two years after the accident and has now been consolidated for six years.

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SOME COMPLICATIONS ARISING DURING THE COURSE OF EXTRAPLEURAL THORACOPLASTY¹

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I HAVE brought into the clinic today three patients with unilateral tuberculosis who were sent to me for thoracoplasty, because each patient had a complication I wish to present the patients, and then to discuss their case histories from the point of view of the complication

EXTRAPLEURAL THORACOPLASTY IN THE PRESENCE OF AN EMPYEMA

The first patient is one in whom, subsequent to long-continued artificial pneumothorax treatment, an infection of the pleural space occurred and an empyema resulted. The patient arrived at the hospital in poor condition. There was an active pulmonary tuberculosis involving the right lung, a pyopneumothorax being present. The middle and lower lobes of the right lung were fairly well collapsed, the upper lobe being held in a position of semicollapse by a firm adhesion which extended from the lateral chest wall to the apex. The upper lobe contained a cavity the size of a golf ball. The fluid level—pus level—extended upwards to the height of the fifth dorsal vertebræ. The heart and mediastinum were slightly to the left. The patient's temperature was septic, ranging from about normal in the morning to 103° F or 104° F in the afternoon. The sputum was loaded with tubercle bacilli and it was often blood-streaked. Here we had several problems to solve. The two conditions—the tuberculosis and the empyema—were both active and both necessitated attention. Which should be taken care of first? Should we drain the empyema, wait until the pleural cavity had been sterilized, and then perform the thoracoplasty, or should we perform the thoracoplasty first while we still had a clean field to work in and then attempt to treat the empyema? If we treated the empyema first, should we do so by the open or closed method? We know that in the

¹ A clinical lecture delivered at the Michael Reese Hospital.

uncomplicated purulent empyema following pneumonia, our chief aim is to re-expand the collapsed lung after the drainage has been established, in order to obliterate the pleural cavity. We realize that rarely does an empyema heal until the cavity has been obliterated. Should we attempt to re-expand this semicollapsed tuberculous lung?

In the first place, we reasoned that the acute purulent empyema, which was causing such severe febrile reactions, must be dealt with as quickly as possible lest the last of the patient's resistance be overcome.

We decided that above all else, in treating the empyema, we must guard against re-expansion of the diseased lung, because in this case re-expansion and mobilization of the right lung would be tantamount to activating and stimulating the tuberculosis. For this reason we decided on the operation of rib resection. Instead of resecting portions of one rib, we resected portions of two, so that the opening would be large enough to allow free access of air to the pleural space and thus maintain the collapse of the lung, and virtually act as a step in the thoracoplasty procedure. The opening was made at the most depended portion in the scapular line, so that the upper thoracoplasty could be undertaken without danger of contamination. The skin edges of the incision were inverted into the cavity in order to delay the closing of the wound. After the establishment of drainage the patient improved markedly. The postoperative treatment consisted of rest in bed, irrigations of the thoracic cavity with warm boric acid solution, and a general hygienic régime. By the end of the seventh day the afternoon temperature was 101.2°F and for the next three days the temperature did not rise above this. Our next step was to deal with the underlying condition of the tuberculosis. This was done by collapsing the chest wall, and resecting posterior segments of the ribs as in the usual thoracoplasty operation. In this case we started with the upper ribs. We did this for several reasons. In the first place the chief activity was in the upper lobe, in the second place the lower lobes were already fairly well collapsed, and in the third place an operation conducted in the upper chest region could be performed without danger of contamination. The first stage was done under ethylene anaesthesia—the subsequent stages under infiltration anaesthesia. A few moments as the ribs were being

all, it took five stages, and as you can see a complete collapse was obtained

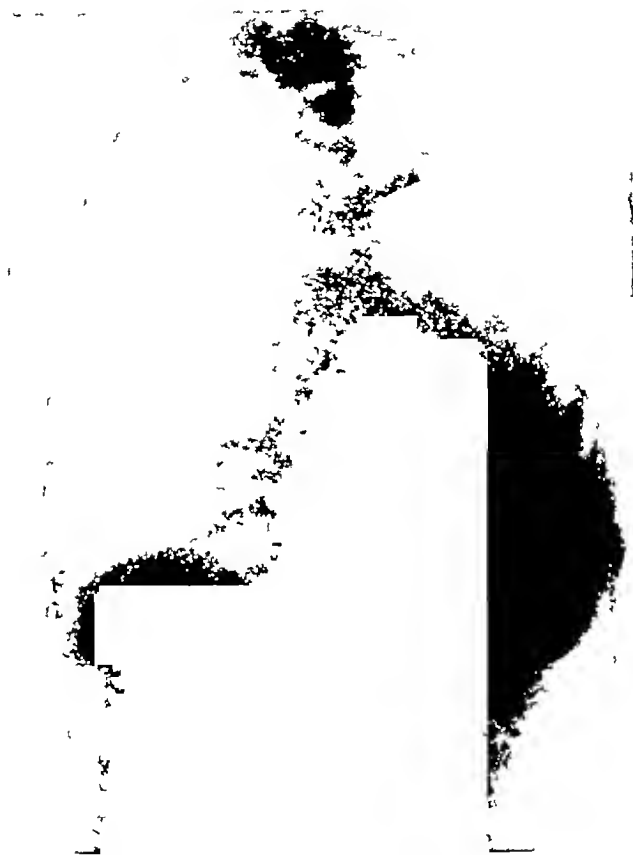
This healthy-looking woman whom I am showing you is the case in point. She is afebrile and her sputum has been negative for tuberculosis for almost two years. She has again been allowed to be among her family and to take care of her child, and for the last year has been doing the housekeeping for the family. She has been forbidden to do the heavy cleaning or the laundry—two of the household chores which, however, she had never been able to do. She reports to us every three months [She still has a sinus from the old empyema which drains about a teaspoonful of pus every day and which necessitates her wearing a dressing continuously, but except for this she is well.]

To summarize briefly, we have here a case for the time being, at least, apparently cured, who had had an active tuberculosis with cavity formation, complicated by an empyema. It was healed by first draining the empyema by the open method and then within a very short time, before any expansion of the lung could occur, collapsing and immobilizing the diseased lung by means of a multiple stage thoracoplasty.

CARDIAC EMBARRASSMENT, FOLLOWING THORACOPLASTY IN PNEUMOTHORAX CASE, RELIEVED BY ASPIRATION OF PLEURAL AIR

This young girl was sent to me a little over two years ago. She had been sick for several years previous to that time. She had received the best of sanatorium care, but in spite of the treatment the disease progressed, and her sputum contained tubercle bacilli. Artificial pneumothorax was tried and the girl started to improve. The improvement was marked for a few months. After that time it was found that a firm ridge of adhesions maintained the expansion of the right upper lobe in which a small cavity could be seen. During the entire time the patient had been under treatment the left lung was free from all signs of tuberculosis. When I first saw her the question arose as to the possibility of performing a pneumolysis, that is severing the pleural adhesions, and thereafter continuing with the pneumothorax treatment. We decided against the procedure because the adhesions were not of the nature of thin bands but rather of a firm ridge or shelf which extended from the mediastinum almost to the lateral portion of the chest cavity. It would have been

Fig 1



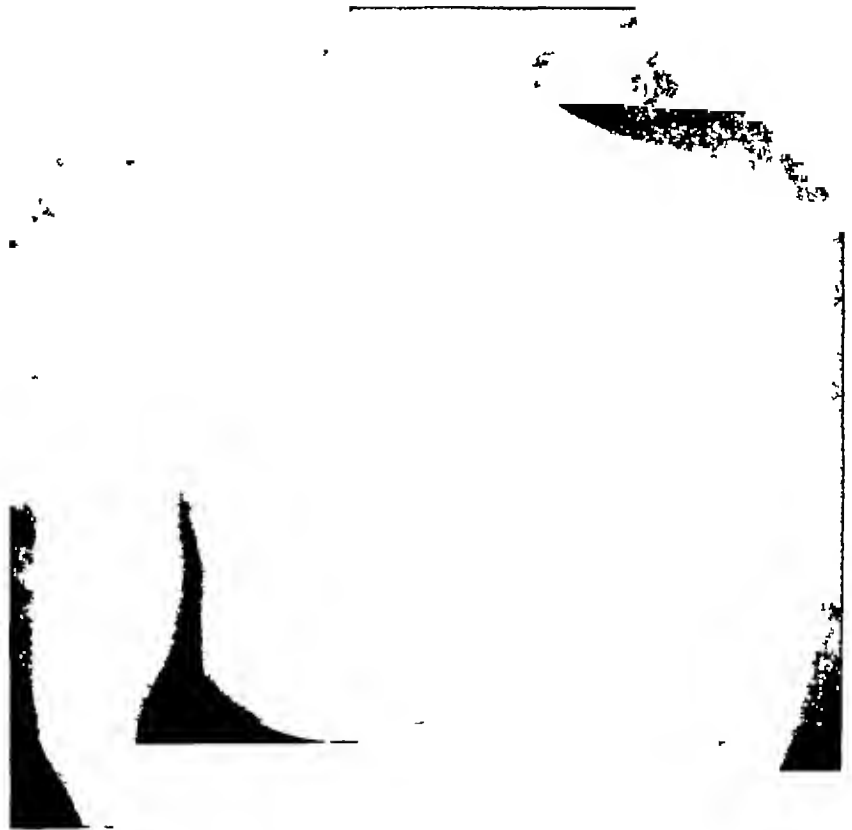
Shows case after complete extrapleural thoracoplasty determining the preservation of the chest contour of the empyema fluid

FIG. 2



Shows the same case after a weak empyema fluid had been aspirated. Note the ideal collapse of the left side bringing about the desired compression and immobilization of the lung.

FIG 3



Shows the scar six months after thoracoplasty. Note the fact that although the excellent compression above alluded to has occurred there will be practically no disability because the shoulder girdle is maintaining the apparent normal form of the thorax.

FIG 4



Photograph taken same time as Fig 3 Shows that motion of the arm has not been interfered with in the lens.

extremely difficult, in the first place, to sever these adhesions and in the second place it would have been impossible to prevent their reformation Thoracoplasty was decided upon

When the girl came to our clinic she was in excellent general physical condition Her left chest was clear A pneumothorax was present on the right side—collapsing the lower two lobes and allowing the mediastinum to retract slightly to the left The upper lobe was held expanded by the adhesions referred to and contained a small patent cavity The sputum was occasionally positive and once in a while an afternoon temperature of 99 4° F or 99 6° F was present

The patient apparently stood the operation of the first stage of the thoracoplasty well. Sections of the eleventh to the seventh ribs were resected

Six hours after the operation, I was called to the hospital, because of the rather sudden change for the worse in the condition of the patient She was cyanotic and dyspnoëic, the pulse was rapid and thready Examination showed nothing abnormal with the recent wound On inspection the apex beat of the heart could be seen in the left axillary line The shift of the heart to the left was verified by palpation and percussion The right lower chest anteriorly was hyperresonant—from the air which had been injected during the pneumothorax treatments It seemed evident that the cardiac embarrassment of the patient was due to the sudden and great displacement of the heart Thoracentesis was performed and the intrapleural air found to be at a pressure of plus four centimetres of water Five hundred cubic centimetres of air were withdrawn The patient's condition changed immediately The cyanosis disappeared, the pulse became strong, regular, and from then on, including the period after the second stage of the thoracoplasty, the convalescence was uneventful The patient is now apparently well—there is no sputum and for the last six months she has been attending high school

This case brings out several interesting points In the first place it shows us that patients in whom a pneumothorax is present should have the "pneumothorax outfit" in their room and ready for use in case signs of increased intrathoracic pressure require release of the air Following the partial thoracoplasty the right side of the chest cavity became materially diminished The lower lobes of the lungs were already collapsed, the upper lobe was held open by adhesions

thus the diminution of the chest cavity had to be taken up chiefly by the left side. As a rule, following pneumothorax the pleura and mediastinum lose a certain amount of their flexibility and, therefore, pressure changes do not so easily occur. Formerly, I was much impressed with the apparent desirability of collapsing the lower portion of the chest first and then the upper. Since then, after having collapsed the upper portion of the chest first in several instances where a large apical cavity was the source of severe hæmorrhages and having had excellent results, I have changed my technic, so that now, in this same case, I would have performed the upper resections as the first stage. The question of aspirating the pleural air before operation arose to be dismissed, because there was no indication whatsoever to re-expand the collapsed and partially immobilized lung areas. In several instances we have aspirated intrapleural air at the time of the operation—withdrawing the air after the ribs have been resected and before the skin is closed. In this way we have maintained any collapse which may have been present and at the same time guarded against too great pressure changes.

For some time we have been studying our chest cases from the cardiac standpoint, with the aid of the electrocardiogram. Although we have not reached definite conclusions, it appears that in certain cases in which the heart shifts easily with change of position there is more danger of postoperative cardiac embarrassment than in those cases with a fairly rigid mediastinum or where the shift of the heart is a straight side-to-side shift and not a rotation.

This case teaches us that in the presence of a pneumothorax it is advisable to let out part of the pleural air as one of the final steps of the thoracoplasty operation so as to guard against undue pressure being exerted upon the mediastinum.

THORACOPLASTY IN THE PRESENCE OF SEROUS EFFUSION

The last patient to be demonstrated today resembles in some aspects the first case and in some, the second.

The patient, a twenty-three year old girl, had been sick with tuberculosis for two years. After a few months she was sent to a sanatorium. There, because the lesion was unilateral right sided—she was given artificial pneumothorax treatment. An excellent compression resulted and her general condition improved. About four

months ago a serous effusion started complicating the pneumothorax régime. An effusion frequently appears during the course of artificial pneumothorax treatment. The treatment, however, can be continued—either by allowing the serous fluid to act as the compressant or, as is done more commonly, draining the fluid and substituting air. In this case the serous fluid has persisted and increased in amount. The general condition of the patient has been less satisfactory, and at the last withdrawal of fluid and substitution of air, small, early adhesions could be seen fixing the apex. It seemed evident that little was to be hoped for and much to be feared from the continuance of artificial pneumothorax, so thoracoplasty was decided upon and the case referred to us.

An exploratory thoracentesis before operation showed that the fluid was a thin straw colored apparently sterile effusion. The general condition of the patient was satisfactory—there was a slight afternoon elevation of temperature. The mediastinum seemed fairly fixed as evidenced by the fact that although there was a massive effusion in the right chest, there was very little deviation of the mediastinum to the left.

In this patient, unlike the first case, there was no indication for drainage of the pleural cavity—in fact on the contrary there was every possible indication not to open the pleural cavity lest a contamination occur and a sterile effusion be turned into an empyema. It was realized, however, that as water is non-compressible no obliteration of the pleural space would occur in its presence. A compression of the chest wall would be directly transmitted by the fluid to the intrapleural structures. In this case, a marked deviation of the heart and mediastinum might be expected after thoracoplasty. For reasons mentioned before, it seemed unwise to aspirate the fluid before operation and thereby re-expand the collapsed lung, especially as much of the pleural effusion usually absorbs speedily after thoracoplasty. At the first stage five ribs were resected. Immediately after the resection about 250 cubic centimetres of fluid was aspirated. The convalescence was uneventful and ten days later the second stage was undertaken. At this time more fluid was aspirated. Ten days after the second stage a roentgenogram of the chest was made. It showed that although the ribs had been sectioned at the usual p

flush with the spinal column, and satisfactory sections had been removed, there was insufficient sinking in of the chest wall. The intrapleural fluid was interfering with a collapse of the chest. As I said before, the pleural fluid usually absorbs, but in this case I was afraid that absorption would be so slow that regeneration of bone from the remaining periosteum would fix the chest before this occurred. It might materially interfere with the final result, because should the chest wall become fixed, then any resorption of the fluid would result in a re-expansion of the lung.

Therefore, it was evident that the fluid should be withdrawn, a procedure which at this stage would not result in a re-expansion of the lung but instead in the desired decrease in circumference of the chest cavity. About a litre of fluid was withdrawn, and the chest wall was tightly strapped in order to bring the chest wall down to the collapsed lung instead of allowing the lung to expand to the chest wall.

These two skiagraphs (Figs 3 and 4), taken before and after the aspiration, show the difference in the size of the right lung area.

It is of interest, too, to note that after this last aspiration the fluid never returned. The patient at present is afebrile, the sputum is negative, and the general condition is good. She is on a schedule of three hours' exercise, and will soon be allowed to return to college.

ANTERIOR ABDOMINAL INCISION

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It is generally recognized that the making of a proper incision in the anterior abdominal wall, is the most important step of an operation. Though much has been written on this interesting and important subject, there is room for general review and restudy of the numerous methods that have been described and practiced by many surgeons.

In this paper, I am presenting brief descriptions of the various abdominal incisions, and balancing them with our present day knowledge of anatomy and physiology.

HISTORICAL

The vertical incision has been the choice of surgeons from the dawn of abdominal surgery. It is impossible to trace back to the first inventor of this incision. Cæsarean section attained a high degree of perfection in the hands of John of Arderne (1306 to 1390) (?) the earliest of the English surgeons. Pietro d'Argelata (died 1423) a professor at Bologna, in his "Cirurgia" (printed in Venice in 1480), described performing Cæsarean section through the linea alba on a dead woman. Roonhuyze¹ (1663) and Voeters (1679) in their "Midwifery" give plates and description of laparotomy. Many laparotomies are recorded in the seventeenth century. In the United States, Ephraim McDowell performed ovariectomy through abdominal incision in December 1809. The expression "abdominal section" was first suggested¹ and employed by Lawson Tait². The transverse and oblique type of incisions is of more recent date.² Mikulicz³ saw his master Bilioth perform a transverse section of the rectus in a difficult stomach operation. In 1894, Rapan⁴ was the first to substitute transverse incisions only through the skin for cosmetic purpose. In 1896 Kustner⁵ conceived the same plan independently and was the first to publish it. Hartman⁶ of Paris first made use of the transverse incision in May 1900, and in the same year Pfann-

neustiel⁷ described the one known by his name. The latter received inspiration for this operation from Kustner's article. L. L. McArthur⁸ of Chicago, in the early months of 1894, described the technique of the muscle-splitting incision before the Chicago Medical Society, but the article was not published till a year later.⁹ Two months later McBurney⁸⁰ described the muscle-splitting operation for the removal of appendix independently.

The transverse incision for the removal of the appendix was originally described by J. W. Elliot¹⁰ in 1896. A. E. Rockey¹¹ and Chaput¹⁰ described the same incision independently in 1905. G. G. Davis¹² of Philadelphia, in 1906. Cutting the rectus sheath and retraction of the rectus muscle inwardly as an extension of McBurney's incision was described by Harrington¹³ in 1899 and by Weir¹⁴ in 1900. Sprengel described his transverse incision in 1910. It is of historical interest that Louis A. Stimson¹⁵ was the first in this country to use the Pfannenstiel incision.

ANATOMY

Since the success and failure of the abdominal incision depends upon anatomical knowledge, it becomes necessary, therefore, briefly to review the normal anatomy of the abdominal wall.

Fascia —The superficial fascia is continuous with the corresponding fascia over the thorax. Toward the lower part of the abdomen it consists of two layers. The superficial fatty layer, known as Camper's fascia, passes over the inguinal ligament and becomes directly continuous with the superficial fascia on the front of the thigh. The deeper layer is known as Scarpa's fascia. It is in direct contact with the aponeurosis of the external oblique muscle. In the region of the pubis, it is carried continuously downward over the spermatic cord, the penis and through the scrotum, into the perineum where it becomes continuous with the dartos and Colle's fascia, which is attached, on each side, to the corresponding body of the pubis. On the lateral side of the spermatic cord, in the region of the groin, Scarpa's fascia ends, immediately distal to the inguinal ligament, by blending with the fascia lata of the thigh.

Rectus Sheath —The rectus muscle is enclosed in a fibrous sheath formed by the blending of the aponeurosis of the external and internal oblique and transversalis muscle. The anterior layer is attached

semilunaris and pass in front of the rectus abdominis muscle to reach the xiphoid process, linea alba, symphysis and the crest of the pubis. Inferiorly, the aponeurosis is folded upon itself to form the inguinal or Poupart's ligament which extends from the anterior superior spine of ilium to the spine of the pubis. The Lacunar, or Gimbernat's ligament, is the medial end of the folded back margin of the inguinal ligament. Its posterior margin is attached to the iliopectineal line and is continuous with the pectineal fascia. Just above the median end of Poupart's ligament, the spermatic cord pierces the aponeurosis of the external oblique and this opening is called the external abdominal ring. The aponeurosis continues down on the thigh as the fascia lata.

The nerve supply of this muscle is from the anterior rami of the sixth to the twelfth thoracic nerve and from the iliohypogastric and ilioinguinal nerve.

The internal oblique muscle lies under cover of the external oblique muscle. It arises from lumbodorsal fascia, the anterior two-thirds of the crest of the ilium and outer two-thirds of Poupart's ligament. The direction of its fibres are upwards, forwards and medially. The uppermost fibres are inserted into the lower three ribs and their cartilages. Intermediate fibres and in a strong aponeurosis which extends from the inferior margin of thorax to the pubis. By that aponeurosis, they gain insertion into the inferior borders of the cartilages of the seventh and eighth ribs and the xiphoid process, and into the linea alba throughout its entire length. The lowest fibres run downwards and medially, and join with the lowest fibres of the transversalis muscle in a flat tendon (conjoined tendon), which is inserted into the pubic crest, and into the iliopectineal line for fully half an inch of its extent. Some fibres are continued down over the cord and testis forming the cremaster muscle.

The internal oblique muscle is supplied by the anterior divisions of the sixth to twelfth thoracic nerve and the iliohypogastric and ilioinguinal nerves. The cremaster muscle is supplied by the genital branch of the genito-femoral nerve.

The transversus abdominis is the deepest muscular layer of the lateral abdominal wall. It arises from the internal surfaces of the lower six ribs and their costal cartilages, interdigitating with the diaphragm, from the transverse processes of the five lumbar ver-

tebræ through the lumbodorsal fascia, from the anterior two-thirds of the iliac crest, and the lateral third of the inguinal ligament. The direction of the fibres is horizontal except the lowest fibres which turn downward and blend with the fibres of the internal oblique muscle to form the conjoint tendon, which is inserted into the iliopectineal line and crest of the pubis. Throughout the rest of its extent, the aponeurosis of this muscle passes horizontally to the midline, and is inserted into the linea alba.

The nerve supply is from the anterior divisions of the sixth to twelfth thoracic nerves and the iliohypogastric and ilioinguinal nerve.

The rectus abdominis arises by two heads, the lateral and larger of the two is attached to the pubic crest, while the medial and smaller is fixed to the ligaments in front of the symphysis pubis. It extends upwards in the interval between the linea alba and linea semilunaris. It is inserted into the anterior aspects of the fifth, sixth and seventh costal cartilages and to the ensiform cartilage. The rectus is broken up into segments by irregular tendinous intersections—the *lineæ transversæ*. There are usually three in number, placed, one at the level of the umbilicus, another, opposite the xiphoid process and a third, midway between them. A fourth intersection, sometimes limited to the lateral portion of the muscle, occurs midway between the umbilicus and the crest of the pubis. The tendinous intersections are adherent to the anterior part of the sheath of the rectus muscle, but they have no attachment to the posterior part of the sheath.

The nerve supply of this muscle is through the anterior divisions of the fifth to the twelfth thoracic nerve.

The pyramidalis is a small, flat, triangular-shaped muscle. It is often undeveloped and sometimes absent. It springs from the front of the pubis and the ligaments of the symphysis and is inserted into the linea alba. It lies anterior to the lower part of the rectus muscle. It is a tensor of the linea alba. It also strengthens the lower part of the linea alba. It is supplied by the twelfth thoracic nerve.

Blood Supply—The chief source of blood supply of the anterior abdominal wall is from the lower six intercostal arteries, the superficial epigastric artery, the superior epigastric, the inferior or deep epigastric, and deep circumflex iliac. The anastomosis is very free.

The lower six intercostal arteries are branches of the aorta.

and musculophrenic and are distributed downwards to the abdominal muscles

The superficial epigastric artery arises from the front of the femoral artery about 1 centimetre below Poupart's ligament, and passing through the femoral sheath and the fascia cribrosa, turns upward in front of Poupart's ligament, and ascends between the two layers of the superficial fascia of the abdominal wall nearly as far as the umbilicus. It distributes branches to the superficial fascia and the integument and anastomoses with branches of the inferior epigastric artery and with its fellow of the opposite side.

The superior epigastric is a terminal branch of the internal mammary artery. It leaves the thorax at the lower edge of the seventh rib, enters the posterior sheath of the rectus and a few inches lower down, enters the substance of the muscle, where it breaks up into small branches. It anastomoses with the inferior epigastric artery from the external iliac.

The inferior or deep epigastric artery arises from the external iliac immediately above Poupart's ligament. It curves ventral, medial and upward in the transversalis fascia and external to the peritoneum. It reaches the edge of the rectus muscle below a line joining the femoral artery at Poupart's ligament with the umbilicus. Opposite the fold of Douglas (linea semicircularis) it reaches the middle of the rectus muscle posteriorly, pierces the transversalis fascia, and enters the substance of the muscle by passing in front of the fold of Douglas. It sends branches to the outer edge of the muscle which are quite large and bleed freely when cut. It anastomoses above with the superior epigastric artery.

The deep circumflex iliac arises from the external iliac almost opposite the deep epigastric artery and passes outwards along the inner side of Poupart's ligament between transversalis fascia and the peritoneum. When it reaches the anterior superior spine it passes between the transversalis and internal oblique muscles and just above the crest divides into an ascending branch which goes upwards towards the ribs and a posterior branch passing backwards to anastomose with the ilio-lumbar branches.

Superficial Veins—The upper part of the abdomen is drained by small branches, emptying into the superior epigastric, the inter-

costal and laterally into the axillary veins. With the exception of the above, all other abdominal veins drain into the femoral vein. These superficial veins cause free bleeding during abdominal incision. All the *deep veins* accompany *arteries*.

Nerve Supply —The abdominal wall is supplied by the anterior division of the sixth to twelfth thoracic nerves inclusive, the iliohypogastric and ilioinguinal nerve. The anterior branches of the lower six thoracic nerves pass behind the costal cartilages and enter the abdominal wall at the margin of the costal arch. These nerves run downward and inward between the internal oblique and transversalis muscles, giving off branches to them. Then they run to the lateral border of the rectus muscle, where they disappear by piercing the posterior lamella of the internal oblique aponeurosis and pass within the sheath of the rectus. They sink into the substance of the rectus muscle and supply it. Then, turning forwards, they pierce the anterior sheath. They end on the front of the abdomen as anterior cutaneous nerves, and supply the skin.

The sixth intercostal nerve supplies the region between the lower end of the sternum and the tip of the ensiform cartilage.

The seventh intercostal nerve distributes to the region near the lower end of the ensiform cartilage. This nerve turns almost at right angles after leaving the costal arch.

The eighth intercostal nerve runs under cover of the costal arch, then, almost in a right angle, downwards and supplies the area of the middle linea transversa between tip of the ensiform cartilage and the umbilicus.

The ninth intercostal nerve runs directly forwards on a level with the ninth costal cartilage, and supplies the region just above the umbilicus.

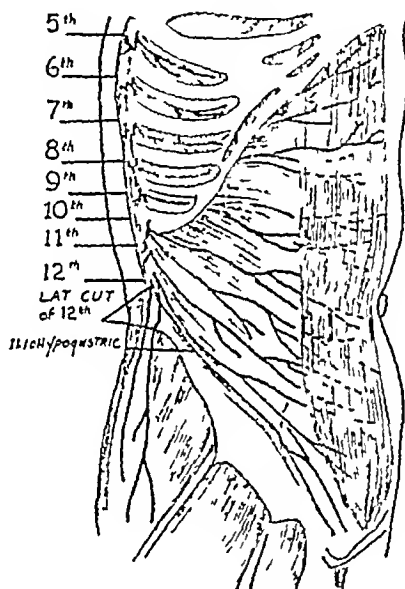
The tenth intercostal nerve runs directly forwards on a level with the tenth costal cartilage, and supplies the skin about the umbilicus.

The eleventh intercostal nerve runs forwards and downwards supplying the region a little below the umbilicus.

The twelfth intercostal nerve runs along the lower border of the twelfth rib passing under the lateral lumbocostal arch, runs in front of the quadratus lumborum muscle, perforates the transver-

salis and passes forward between the transversalis and internal oblique muscles (1) The anterior branch of the twelfth intercostal penetrates the rectus and is distributed below a point midway between the umbilicus and pubis (2) The lateral cutaneous branch of the twelfth intercostal penetrates the internal oblique muscle, then emerges from the external oblique from 2.5 to 8 centimetres (about 1 to 3 inches) above the iliac crest and is distributed to the skin over the ventral surface of the hip

FIG 1



The nerve supply of the abdominal wall

The iliohypogastric nerve arises from the first lumbar nerve. It is the highest branch given off by the first lumbar nerve, after its emergence from below the first lumbar vertebra. This nerve emerges from the upper part of the lateral border of the psoas major muscle and crosses obliquely in front of the quadratus lumborum muscle to the iliac crest. It then perforates the posterior part of the transversus abdominis muscle near the midpoint of the crest of the ilium, and divides between the transversalis and internal oblique muscles into a lateral and anterior cutaneous branch. (a) The iliac branch pierces the internal oblique and external oblique muscles directly above the crest of ilium, and supplying the skin of the gluteal region.

posterior to lateral cutaneous branch of the twelfth thoracic nerve (b) The anterior cutaneous or hypogastric branch continues onward between the internal oblique and transversalis muscles, and pierces the internal oblique and perforates the aponeurosis of the external oblique about 2.5 centimetres above the external inguinal ring and is distributed to the skin of the hypogastric region. It communicates with the twelfth thoracic and ilioinguinal nerves. It does not enter the sheath of rectus, but supplies the skin of the hypogastric and external inguinal ring region. The ilioinguinal nerve arises from the first lumbar nerve. It emerges from the lateral border of the psoas major muscle just below the iliohypogastric nerve and passes

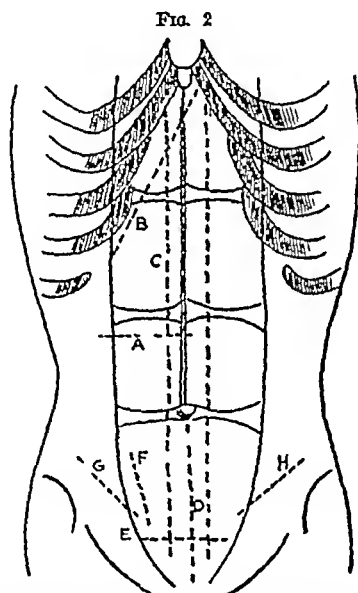


FIG. 2
Surgical incisions. (a), Spengler's incision. (b) Kocher's incision. (c) Paramedian incision, with lateral retraction of rectus. (d) Midline (infraumbilical incision). (e), Pfannenstiel's incision. (f), Transrectal incision appendix. (g), McBurney's incision. (h-l) Inguinal colostomy incision.

obliquely across the quadratus lumborum and iliacus muscles, perforates the transversalis muscle near the anterior part of the iliac crest and communicates with the iliohypogastric nerve between the transversalis and internal oblique muscle. It then pierces the internal oblique muscle distributing filaments to it and accompanies the spermatic cord through the external inguinal ring. It supplies the skin of the upper and inner aspects of the thigh and scrotum in male, and the labium in the female.

VARIOUS INCISIONS

Liver—The liver is exposed by the following routes

(1) Through an anterior incision opening the peritoneal cavity as in exposure of the gall bladder (midline, transrectal, pararectal, paramedian with the lateral retraction of the rectus muscle)

(2) Anterior oblique incision parallel with the costal arch, and 1.3 to 2 centimetres ($\frac{1}{2}$ to $\frac{3}{4}$ inch) mesial to it, beginning near the right linea semilunaris and extending as far downwards and outwards below the costal arch as necessary. Care is especially exercised to avoid wounding the pleura behind the seventh costal cartilage. The portion of the chest wall thus mobilized is then displaced outwards and upwards by retractors. It might be necessary, for better exposure, to extend the original incision further backwards below the costal arch. A composite flap may be hinged downwards and inwards in the following manner. The skin, fascia, and overlying muscle fibres are divided below and parallel with the costal arch until the plane of the costal arch is reached, then the cartilaginous portion of the ribs is carefully incised with a sharp knife.

(3) Chondroplastic or costo chondroplastic (Lannelongue,¹⁶ 1888). A slightly curved incision is made from the xiphoid process to the anterior end of the bony portion of the tenth rib, passing parallel with the chondral arch, and about 1.2 to 2 centimetres ($\frac{1}{2}$ to $\frac{3}{4}$ inch) below it. Between the rectus and external oblique muscles on the outer aspect and the internal oblique and transversalis on the inner aspect, the lower border of the costal arch is exposed and can be easily freed. The insertion of the seventh costal cartilage is divided at the sternum and similarly the eighth and ninth costal cartilages are divided just distal to the bony ends of their corresponding ribs, or if necessary, the ribs themselves are divided just proximal to the costal cartilage attachment.

(4) Incision parallel with and about 1.3 to 2 centimetres ($\frac{1}{2}$ to $\frac{3}{4}$ inch) below the right twelfth rib, with its centre about opposite the midaxillary line.

(5) Right sided transverse lumbar incision running parallel with the twelfth rib, cutting through muscles and slightly incising the quadratus lumborum and long muscles of the back.

(6) Transperitoneal exposure of the lower lateral border of the liver. This incision is made parallel with and about 1.3 to 2 centimetres ($\frac{1}{2}$ to $\frac{3}{4}$ inch) below the right twelfth rib, with its centre about opposite the midaxillary line. It includes the skin, fascia and external oblique. The latissimus dorsi may be incised transversely and the serratus magnus separated if the incision extends that far backwards. The internal oblique and transversalis are cut in the direction of their fibres, the nerves between them being guarded as well as possible. The peritoneum is opened in the original line of incision.

(7) Subpleural route. (a) Right sided transverse lumbar incision. This incision runs parallel with the twelfth rib. It cuts through the abdominal muscles and slightly incising the quadratus lumborum and long muscles of the back, exposes the lower border of the twelfth rib. The latter is then either forcibly retracted upwards or, if necessary, is subperiosteally excised, being careful to avoid the pleura. By blunt dissection the posterior part of the liver is reached.

(b) Intercostal subpleural route. Incision is made between the lower border of the right tenth and the upper border of the right eleventh ribs, in the mid-axillary line. This incision is below the level of the pleura.

(c) Subpleural route If the liver is not adherent to the diaphragm, one, two or three ribs are excised in part. Having passed through the thoracic wall, the diaphragm is exposed, and incised in a line corresponding with the direction of its muscle fibres. The edges of the diaphragmatic wound are sutured to the convex surface of the liver, if not already adherent. The liver may be incised at once, or the wound packed with gauze to produce adhesions and opened two or three days later. In this operation part of the right tenth and eleventh ribs are removed in the midaxillary line subperiosteally, below the level of the pleura.

(d) Parts of one or more ribs (seventh and eighth in the antero lateral aspect of the chest wall) are excised subperiosteally above the level of the pleura, then the pleura is exposed but not opened, and is carefully separated from the thoracic wall and diaphragm and displaced upwards. If adhesions are present, the diaphragm is incised and the abscess drained. If no adhesions are found, the diaphragm wound edges are sutured to the liver, packed with gauze and opened in two or three days.

(8) Transpleural Operation (a) Through an anterior incision along the seventh or eighth ribs which are resected. The pleural cavity is traversed and the diaphragm incised.

(b) In the posterior method an incision about four inches in length is made along the line of the space between the eighth and ninth ribs, the middle of the incision corresponding approximately to the posterior axillary line. The latissimus dorsi and the external oblique muscles are divided and the ribs are exposed. An incision is made along the centre of the outer border of each rib through the periosteum, which is carefully stripped from the anterior and posterior surfaces of the ribs for $2\frac{1}{2}$ to 3 inches, the denuded portions are then excised. The pleura is now exposed. Before opening, the pleura is sutured to the diaphragm by a series of deep stitches, passed close to one another and drawn fairly tightly. These stitches pass through the intercostal muscles as well as through the pleura above and below and at each end of the divided ribs, through the periosteum. In the centre of this circle of sutures, an incision is made into the pleura. The upper surface of the diaphragm is now seen and is at once incised and the liver exposed.

Gall Bladder—Rio Branco incision²² is composed of two parts which form an acute angle with a rounded tip, whose opening extends towards the right and upwards. Its vertical portion follows the linea alba from the tip of the xiphoid process to the umbilicus, its transverse portion, from the umbilicus upwards and outwards towards the right costal margin which it reaches near the anterior end of the ninth or tenth rib. It results in a triangular flap when it is lifted and gives a good exposure of the subhepatic region. If more room is necessary, extend the incision downwards to include the umbilicus in the angle of the flap.

Löbker²⁷ incision is a midline incision.

Lawson Tait incision²⁸ extends vertically from the costal arch directly downwards through the outer part of the right rectus muscle.

Langenbeck²⁴ incision is a vertical incision through the external edge of rectus muscle, in its avascular area. This is similar to the *Felicet*, *Peau* and *Vincent incisions*²⁵. Langenbeck also described an incision in the form of an L but placed in such a way that the vertical portion corresponds to the external edge of the rectus, and the transverse portion to the upper part of the muscle.

de Roubaix incision²² begins, in the linea alba, one inch below the xiphoid process, then runs obliquely for a distance of three or four inches in an outer and downward direction, through the right rectus muscle and, finally, in a horizontal line in an outward and backward direction. The flap is convex in the lower inner portion and gives a good exposure. *Parlcs,¹⁹ Boeckel and Willet²³* have used and described a similar incision.

Courvoisier²⁴ incision is made at the edge of the liver, regardless of the size of this organ, and slightly above its lower border.

Sprengel²⁵ incision is situated parallel to the costal arch. It is purely oblique but like a hook made in such a fashion that the shorter external arm of the hook corresponds to the external oblique muscle whose fibres are bluntly separated, while the long arm divides the rectus muscle and may extend laterally to the internal oblique and transversalis according to necessity. For gall bladder exposure alone, the incision need only extend laterally to the outer margin of the rectus muscle. If more room becomes necessary, the left rectus can be partly or wholly divided transversely.

Riedel²⁶ incision begins four centimetres above the lower end of the sternum (not of the ensiform process) and passes obliquely downwards through fascia and muscle between the base of the ensiform process and costal arch, which it parallels until it reaches the middle of the rectus muscle, where it becomes vertical and terminates above the umbilicus. Important branches of the internal mammary artery may have to be ligated.

Perthes²⁷ incision is a vertical incision which begins immediately below the ensiform cartilage 2 centimetres ($\frac{3}{4}$ inch) to the right of the median line, and extends to a point directly lateral to the umbilicus. At this point the incision turns outwards and slightly upwards towards the costal arch, the rectus is cut transversely and stitched to the anterior sheath to prevent retraction. It is then retracted with its anterior sheath and the posterior sheath with peritoneum is opened in an oblique line paralleling the right costal arch from the upper to the lower level of the wound.

Bakes²⁸ Incision. Bakes suggests not cutting through the left rectus as does Sprengel, but through the linea alba and the anterior sheath, retracting the left rectus laterally.

König²⁹ incision is a transverse incision in the right rectus and an arch shaped continuation extending in a medial upward direction which, according to necessity, indents the fascia or extends upward for a distance of 2 to 4 centimetres in the median line. The level at which the rectus is divided varies according to the site of the gall bladder or lower edge of the liver.

Lejars³⁰ incision is an angular incision with an acute angle. It is commonly used in cases of traumatic injury of the liver. The incision consists of a vertical portion in the linea alba from the xiphoid process to the umbilicus, and an oblique incision running along the edge of the ribs.

Sencert³¹ Incision. Sencert describes a similar incision to that of Lejars, in the left side, for examination of left hypochondrium.

Mayo Robson³² incision is a vertical incision downwards from just below the costal arch through the outer part of the right rectus muscle, from the upper end of which an oblique incision is carried upwards and inwards parallel with the right costal arch, to the ensiform cartilage.

Bruning²⁰ incision is a longitudinal incision at the edge of the inner third of the right rectus muscle. The muscle is separated by blunt dissection.

Trinkler²¹ Incision Trinkler describes an incision whose first part is the same as that described by Edebohl for exposure of the right kidney. This incision extends from the twelfth rib to the middle of Poupart's ligament. From the middle of this incision and perpendicular to it Trinkler makes a second incision parallel to the costal arch, and 4 centimetres distant from it. This extends as far as the external edge of right rectus or may go through the external third of the muscle. The first part of the incision may be made shorter and only extend as far as the umbilicus.

Kausch²² (1889) introduced an oblique incision in the Mikulicz Clinic. The incision begins at the costal arch in the mammary line and strikes the median line at a point one to three finger breadths above the umbilicus. It follows the course of the intercostal nerves and saves injury. When this does not give enough room, an incision in the linea alba is added. (This is similar to the new incision described by Rio Branco.)

Desjardine²³ (1907) suggested an incision in the form of a Z. Others have been in form of T, H and X. Rio Branco mentions trying all of them.

Czerny²⁴ (Czerny Kocher) incision is a hook angular incision beginning in the midline at the ensiform cartilage and running along the linea alba downwards to two-thirds of the distance to the umbilicus, where it turns outwards and slightly upwards towards the costal arch. This cuts the rectus and part of the oblique muscles in a transverse direction.

Kehr's²⁵ wave or bayonet incision begins close to the tip of the ensiform cartilage and passes vertically downwards in the midline, for about 4 to 6 centimetres (1 9/16 to 2 6/16 inches) is then directed obliquely outwards, parallel with the costal arch to the outer third of the rectus, when it again becomes vertical and ends at the umbilicus. The incision through skin and fascia exposes the preperitoneal fat in the upper part of the median line, crosses the second linea transversa obliquely to the outer third of the muscle, and then, passing downwards, divides the inner two-thirds of the anterior sheath of the right rectus and splits the outer third of its fibres.

Kehr's²⁶ bow shaped incision begins in the median line at the ensiform cartilage. Passes directly downward in the linea alba for from 4 to 6 centimetres (1 9/16 to 2 6/16 inches) and then curves obliquely downwards and outwards toward the right costal arch. This is similar to Korte's²⁷ hook incision.

Moschcowitz²⁸ described a transverse incision in the upper abdomen with division of both recti muscles. It is a modification of the Sprengel and Bakes incisions.

Kocher²⁹ incision is an oblique incision from the tip of the ensiform process to a finger's breadth below and at first parallel to the costal margin, after which it descends as far as the muscular fibres of the external oblique, which may be slightly incised. The rectus is divided across its whole breadth and the nerves supplying it, which run obliquely from without downwards and inwards on the transversalis, are drawn aside. A few branches of the superior epigastric artery are cut and tied in the muscle.

Bevan³⁰ incision is an S shaped incision, beginning at the ensiform cartilage, curving down a little until it reaches the middle of the rectus becoming vertical for four to six inches and then curving outwards like an old fashioned letter S.

Having made the skin incision, the anterior sheath of the rectus is divided over its centre and the muscle bluntly separated. The posterior sheath and peritoneum are now opened.

Doyen⁴⁰ incision is a vertical incision which begins over the right costal arch, a little to the inner aspect of the mammary line, and passes directly downwards over the eighth, ninth and tenth costal cartilages, to terminate at the level of the umbilicus. The abdomen is opened below the cartilage of the tenth rib, and the cartilages of the tenth, ninth and eighth ribs are divided in the same vertical line without wounding the pleural cavity. From 1 to 2 centimetres of the exposed portions of these cartilages are excised, and the wound is thoroughly retracted for satisfactory exposure.

Sloan⁴¹ incision is made through the skin and subcutaneous tissue down to the aponeurosis extending from the ensiform to a point 3.5 centimetres above the umbilicus. It is continued outwards and downwards on either side of the umbilicus to a point on either side about 4 centimetres below the umbilicus, leaving a V-shaped piece of skin and subcutaneous tissue around the umbilicus. A flap of skin and fat dissected outwards exposes the aponeurosis over the inner border of both recti muscles. Vertical incisions are then made through the external sheath of the recti about 1 centimetre lateral to their inner borders. Upon the length of these two incisions will depend the amount of exposure that is obtained.

The recti with the overlying external sheath, fat and skin are rolled outwards and held by suitable retractors. A transverse incision is made through the exposed posterior sheath of the rectus and the peritoneum and extended across the linea alba parallel to the direction of the fibres from the outer edge of one rectus muscle to the outer edges of the other. This opening gives an excellent exposure of the stomach and duodenum. The opening can be retracted over the regions of the gall bladder, spleen or appendix.

Graham⁴² incision is a vertical skin incision about $\frac{3}{4}$ inch (1.5 centimetres) made to the right of the midline, extended downwards from a point about 1 centimetre below the costal arch to a point about 1 centimetre below the umbilicus and carried through the anterior sheath of the rectus muscle. The muscle is not divided but separated by blunt dissection from its attachment to the midline and then retracted laterally. The posterior sheath and peritoneum are divided in a line approximately corresponding with that of the incision through the anterior sheath. If more room is necessary the upper part of the rectus muscle is cut transversely by extending the upper angle of the incision diagonally upwards to the ensiform cartilage, in a manner similar to the Mayo-Robson incision, or the sheath of the rectus can be cut transversely to permit a greater retraction of the uncut muscle. If more exposure is desired at the lower part, the vertical incision is merely extended downwards.

Quain⁴³ incision. Quain prefers a straight transverse incision in the upper abdomen for routine gall bladder and stomach operation. The technique is very similar to that of Sprengel, Bakes and Moschcowitz. It is described by Quain as follows:

"A straight transverse incision made about two inches above the level of the umbilicus. The incision is carried down through the aponeurosis from a point near the linea alba and outwards to, or beyond, the linea semilunaris. Only the outer fibres of the rectus muscle are cut at first. The posterior aponeurosis near

the semilunar line is exposed and split The transversalis muscle and fascia with the attached peritoneum is opened sufficiently to the costal margin, or across the linea alba and left rectus as desired

Mayo " (Judd ") straight oblique incision for gall bladder Judd " The superficial incision begins to the right of and close to the xiphoid cartilage This will be near the midline, beginning directly beneath the ribs, to the right of the ensiform and passes downwards in a straight but slightly oblique line, to a point about 2 inches to the right of and immediately on a line with the umbilicus This divides the skin and exposes the anterior rectus sheath The deep incision is made through the latter, a straight vertical cut parallel with the midline This will cross the course of the superficial incision at a very acute angle, and split the fibres of the rectus muscle approximately one inch to the right of the umbilicus The fibres of the rectus muscle are separated by blunt dissection after which the posterior rectal sheath is incised in the same line with the anterior sheath before opening the peritoneal cavity Mayo " says this incision is based on that of Bevan. Mayo follows the suggestion of McArthur and leaves the posterior sheath of the rectus and the peritoneum uncut in the lower quarter of the incision. These tissues can be retracted readily and protect the lower part of the wound against hernia

McArthur " incision is a vertical one to the posterior sheath of the rectus (Outer border) All tissues are then freed from the transversalis fascia and muscle for some distance around and a transverse incision opens the peritoneum The separation of the transversalis muscle and fascia is from 3 to 6 inches in length, allowing easy retraction up and down

Ashurst (reported by Boykin ") uses routinely in the upper abdomen and pelvis a right or left paramedian incision After opening the anterior sheath of the rectus the muscle is dissected free along its inner border and retracted outwardly The posterior sheath and peritoneum are opened beneath

In operations upon the gall bladder, a right paramedian oblique incision is used This incision begins across the midline just below the ensiform, extending downwards and outwards across the right rectus to just beyond the linea semilunaris at a point below the level of the umbilicus The anterior sheath of the rectus is opened in the direction of the skin incision, the muscle dissected free along the inner border and lifted outwardly, and the posterior sheath and peritoneum opened beneath in a line parallel to the linea alba

Collins " incision. Collins describes a right paramedian incision retracting the rectus muscle laterally for gall bladder operations He has called this a tongue and groove incision

Mason " has described a longitudinal and transverse incision " This incision is based on the principle of the Kammerer incision, that of the displacing the rectus muscles outward, and of the Mayo operation for the relief of umbilical hernia "

Spleen—Numerous incisions have been described for the exposure of the spleen The following incisions are more commonly used

Oblique subcostal incision runs parallel with and about 1.3 centimetres ($\frac{1}{2}$ inch) below the left costal arch, with its centre over the spleen, the inner border of which comes to within 4 to 5 centimetres ($1\frac{1}{2}$ to 2 inches) of the median plane, its outer border extending just posteriorly to the mid axillary line This incision

is commonly used for draining abscesses of the spleen and can reach this gland in the following manner without much disturbance of normal anatomy

(1) Incise the skin and fascia, (2) incise the external oblique transversely, (3) separate the internal oblique in the line of cleavage, (4) retract the nerves carefully, (5) divide transversalis obliquely, (6) divide transversalis fascia and peritoneum in the line of the original wound

Vertical incision through the left linea semilunaris or outer margin of left rectus muscle with inward extension of the incision below and parallel with the left costal arch (left sided, Bevan²⁰ S shaped, or Mayo²¹ incision)

Median abdominal section, beginning below the ensiform cartilage and extending as far below the umbilicus as needed

Vertical incision over the outer border of the left rectus muscle, with an extension of its upper end (if more room is necessary) upwards and backwards in the eighth intercostal space and excision of the cartilages of the eighth, ninth and tenth ribs (Auvray²²)

Vertical incision, beginning at the cartilage of the left seventh rib slightly mesial to the mammary line, and extending downward to the level of the umbilicus, with excision of a part of each rib (Doyen²³)

Parallel subcostal incision with resection of eighth, ninth and tenth costal cartilages

Transverse incision of the left upper abdomen, by cutting the rectus transversely (Sprengel²⁴) or retracting medially (Boykin²⁵)

Left paramedian incision (Moynihan²⁶)

Left rectus incision and separation of its muscle fibres

Bevan²⁷ has simplified and improved on his old S shaped incision. He has described a straight midline incision for all spleen operations. If additional room is required, the incision should be enlarged by dividing the rectus transversely

Pancreas—For the approach to the pancreas, the abdomen is opened by an incision between the ensiform cartilage and the umbilicus in the midline, or to one or the other side of it, as seems necessary for speedy access to the part. In cases of acute pancreatitis and pancreatic cysts Moynihan²⁸ advocates opening the abdomen by a paramedian incision above the umbilicus, with lateral displacement of the rectus muscle

Stomach—Midline incision is made through the linea alba, between the xiphoid cartilage and the umbilicus. This incision is usually from 5 to 10 centimetres (2 to 4 inches) in length

Right or left paramedian incision is made vertically over the right or left rectus sheath parallel with the midline and at a distance of about 2 centimetres ($\frac{3}{4}$ inch) from it, beginning at the costal arch above and extending downward for about 7.5 centimetres (3 inches). After incising through the anterior rectus sheath, some surgeons separate the rectus muscle vertically in its centre (trans rectal). It is preferable to retract the muscle laterally and expose the posterior sheath with the peritoneum directly under the same line

The oblique subcostal incision has been described for the exposure of the cardiac end of the stomach on the left side. This incision begins near the tip of the xiphoid cartilage and extends downward and outward, parallel with and about 2.5 to 3.7 centimetres (1 to $1\frac{1}{2}$ inches) to the inner side of the left costal

arch, ending about opposite the anterior end of the ninth rib, extending for a distance of about 7.5 centimetres (3 inches) or more as necessary

The Baudet Navarro²² technique consists in a temporary resection of the left costochondral arch for the exposure of the cardiac end of the stomach. This technique is the same as has been described on the right side for the exposure of the liver.

Incision for gastrostomy (Stamm,²⁷ Senn,²⁸ and Kader²⁹), a vertical incision 5 to 7.5 centimetres (2 to 3 inches) over the outer third of the left rectus muscle, extending from the left costal arch downward, is very satisfactory. Some surgeons have described oblique paracostal incisions for this purpose (Marwood,³⁰ Szabancz,³¹ and Witzel³²). Franck³³ makes a smaller cutaneous incision above the paracostal one and pulls the delivered portion of the stomach well through it, in order to form a valve. The deeper incision separates the left rectus with anterior and posterior sheath vertically, as in the above mentioned operation.

Duodenum—Right paramedian incision with lateral retraction of the rectus muscle or midline incision supraumbilically are commonly used for the exposure of the duodenum.

Jejunum—The jejunum is exposed by a midline or a paramedian incision. For jejunostomy, Mayo,³⁴ Summers,³⁵ Madyl,³⁶ Mayo Robson³⁷ and Moynihan³⁸ use a high left transrectal incision. Von Eiselsberg³⁹ and Witzel³² have used median or left paramedian incisions for jejunostomy. Ravdin⁴⁰ has reported a new technique for jejunostomy. It avoids the necessity of making a large incision for the exposure of the upper jejunum and, therefore, obviates the constant difficulty of handling the protruding distended coils of bowel. A vertical incision about 2 inches long and through to the peritoneum is made just posterior to a prolongation of the left anterior axillary line beginning at the tip of the eleventh costal cartilage. The peritoneal incision is one inch long and the high loop of the jejunum appears in the field in the majority of cases.

Ileum—An approach to the distal coils of the small intestine is generally made through a median or paramedian incision below the umbilicus.

Right inguinal enterostomy (ileostomy), cæcostomy (right inguinal colostomy) and appendicostomy (Weir's operation⁴¹) are all performed through a right gridiron incision (McBurney incision⁴²).

Appendix—There are many incisions described for the removal of the appendix.

Sheldon⁴³ and Meucci⁴⁴ describe a lumbar incision for the drainage of appendiceal abscesses.

Vischers⁴⁵ lumbo iliac incision lies one inch above and parallel with the crest of the ilium, beginning at the outer border of the external oblique (which corresponds with about the centre of the iliac crest) and ending opposite the anterior superior spine of the ilium, or even extending forward parallel with the outer part of Poupart's ligament. This incision does not harm the abdominal nerves, but has a limited use, because of the poor exposure. It has been used for suppurating appendicitis. Grinda⁴⁶ described a similar operation for the drainage of appendiceal abscess.

Fowler's⁴⁷ angular incision begins at the upper border of the anterior superior spine of the ilium. It runs horizontally inward to the outer border of the rectus muscle, curves thence downward and runs parallel with the outer border of the rectus for 2 to 3½ inches. The skin and fascia are incised along

the above lines, exposing the aponeurosis of the external oblique, which is separated by blunt cleavage, exposing the internal oblique and anterior rectus sheath. The rectus muscle and deep epigastric vessels are retracted medially, the aponeurosis, externally and a horizontal incision, corresponding to that of the skin, opens the peritoneal cavity.

The Lecene¹⁸ posterior subiliac incision is 8 to 10 centimetres in length. The incision lies about 2 centimetres above the anterior superior spine, dividing the muscles in the direction of their fibres. By wide retraction the transversalis fascia and peritoneum is brought in view, and opened. This operation is intended for the drainage of the appendiceal abscess.

The Whitlocke¹⁷ incision is half an inch internal to and parallel with the anterior superior spine of the ilium, extending above and below it. After going through skin and fascia, the muscles are divided in direction of their fibres. Peritoneum is divided anteriorly in clean cases. If an abscess is to be drained, the peritoneum is turned inward and incised posteriorly from the iliac fossa. Similar technique was reported by Wood¹⁹ in 1924.

Descamps²⁰ incision is suitable for the exposure of a retrocecal appendix. This incision is 4 to 6 centimetres long, and is perpendicular to a line drawn from the anterior superior spine of the ilium to the umbilicus, about where its middle and external thirds join. Opening the peritoneum parallel with colon down to the iliac fossa and turning back the colon, the appendix is approached.

Transverse incision (Elliot,²⁰ Rockey,²¹ Chaput²⁰ and Davis²²) permits an excellent exposure and no muscles or nerves are cut. The technique is as follows. The incision is on a line which extends from the anterior superior spine of the ilium to the linea alba. The incision is usually 6 to 8 centimetres long and centres on the linea semilunaris. It could be made at a higher or lower level if necessary. The skin and subcutaneous tissue are cut, exposing the aponeurosis of the external oblique and the anterior sheath of the rectus. These are split in the direction of the skin incision and the rectus retracted inwardly, thus putting on a stretch the internal oblique and transversalis muscles, which are split outwardly in the direction of their fibres. Posterior sheath is then split transversely inward as far as needed, and the peritoneum opened. The twelfth thoracic nerve is sometimes encountered running nearly parallel with the incision, but injury to it is obviated by pushing it to one side. When better exposure is needed the incision may be extended outwardly to the anterior superior spine and inwardly to the linea alba.

McBarney²³ describes the technique for the removal of appendix as follows: "The skin is divided along an oblique line about 3 to 4 inches in length, which begins $1\frac{1}{2}$ inches above, and internal to, the anterior superior spine, and thence passes downwards and inwards. When the skin and subcutaneous tissues are divided, it will be seen that the line of the incision corresponds precisely with the line of direction of the fibres of the external oblique. These fibres are split by making a small cut through them, and then with the fingers they are gently separated. The internal oblique and transversalis are split in the direction of their fibres, that is, at almost a right angle with the fibres of the external oblique. The separation of the fibres of the two muscles is most easily affected by making a small incision through their common aponeurosis just at the outer margin of the rectus muscle and by enlarging this small cut by the introduction of a blunt scissors or the tip of a finger and then gently pulling the fibres apart. The separa-

peritoneal approach The peritoneum can be opened and the appendix removed through this incision This is an incision similar to that originally employed by Hancock⁶⁴ and Sonnenburg⁶¹

Edebohl's⁶² claimed that movable kidney was a cause of appendicitis He practiced nephropexy and appendectomy through the same lumbar incision

Roux⁶³ introduced an oblique incision in 1890 for removal of appendix The peritoneum, when reached, was opened only in the superior external part of the wound just over the cæcum The room obtained with such exposure was not satisfactory

Morris incision⁶⁰ is an oblique incision about $1\frac{1}{2}$ inches long, made in a line following the direction of the external oblique fibres The distal end of the incision terminates at the right margin of the right rectus muscle The skin, fascia and the muscles are separated by blunt dissection The transversalis fascia and the peritoneum are then incised This incision has never gained popularity, because of insufficient exposure

*Finney's modification of the McBurney incision*⁶⁵ Finney suggested dissociation of skin and muscle incision for the purpose of protecting the deep wound The deep incisions are displaced from the skin incision as the wound is closed

Cæcum and ascending colon—The removal of the cæcum and ascending colon followed by an ileocolostomy can be performed through the following routes

(1) Right paramedian incision Moynihan⁶⁴ suggested that this incision should be ample in size, from 6 to 8 inches long, (2) vertical incision over the outer part of right rectus muscle, 5 to 6 inches long, (3) incision in the right semilunar line, (4) anterior axillary line, beginning midway between the lower margin of the costal cartilages and the iliac crest, and passing downward to within about 4 centimetres ($1\frac{1}{2}$ inches) of the anterior superior iliac spine, and thence running downwards and forwards, parallel with the outer half of Poupart's ligament.

Transverse colon—The transverse colon is exposed through a midline incision or by a right or left paramedian incision according to the situation of the growth

Descending colon—The same incisions that are described for the ascending colon on the right side are used on the left side for the exposure of the descending colon

Sigmoid Colon—The following incisions are described for colostomy

Mixter's⁶⁶ anterior colostomy commences at the level of the umbilicus and passes downward for about two inches, cutting through the skin and rectus fascia This part of the incision parallels the rectus fibres a short distance medial to its outer border At this point the knife turns inwards at a right angle, then downwards, and again outward to form three sides of a square, the length of each of which will be approximately three inches The cut finally turns downwards at a right angle for two inches, as a continuation of the first leg of the incision, parallel with the fibres of the rectus The lid of skin and anterior rectus fascia is dissected away from the belly of the rectus muscle, and reflected outwards after which the muscle fibres are separated longitudinally by blunt dissection near the outer border of the muscle and the peritoneum opened. After the sigmoid is withdrawn from the abdomen the middle portion of the separated rectus muscle is sewed together between the two limbs of the intestine The coil of sigmoid now arches across the approximated portion of the rectus muscle,

and under this arch the lid of the skin and fascia is drawn, to be fastened firmly into its original position with two layers of interrupted stitches, one for fascia, the other for skin. The principle of this operation is to use the rectus muscle as its sphincter to assist in the control of evacuations.

Sistrunk's⁷⁷ incision is a straight left transrectal incision and is placed below and about one inch to the left of the umbilicus. This is similar in type to the one described by Mixer.

Left inguinal colostomy (Tuttle,⁸⁸ Lilenthal,⁷⁹ Madyl,¹⁰⁰ McGraw,¹⁰¹ Allingham,¹⁰² Gant,¹⁰³ Rankin¹⁰⁴.) Some surgeons prefer a low midline incision for exploration and a smaller inguinal incision for the performance of colostomy. Rankin prefers to make a muscle-splitting incision well toward the anterior superior spine of the ilium, in the left lower abdominal quadrant through which adequate exploration may be carried out. This incision bisects, at right angles, a line drawn from the umbilicus to the anterior superior spine. This operation is exactly the same as the McBurney incision for the removal of the appendix, except that it is performed on the left side.

Pelvic Operations.—The midline longitudinal incision, below the umbilicus, is commonly used for pelvic operations, because it gives ample exposure and can be extended upwards as needed. Care must be taken to avoid injury to the bladder. In cutting through the abdominal wall, the incision may be made through the linea alba. Some operators make this a little to one side of the tendinous median line and include some of the rectus muscle of that side. This is an easy incision to make, but much care should be taken in closing it, otherwise, hernia may result. The sheaths of both recti muscles should be incised so that the posterior sheath of the opposite rectus can be included with the peritoneum in the closure. Muscles from both sides should be brought together with sutures and the anterior rectus sheath from both sides should be carefully coapted.

Bardenheuer's¹⁰⁵ incision is an extended transverse incision for difficult pelvic operation. This incision has been used frequently abroad, but very little in this country. This incision is carried with a moderate downward curve from one anterior superior spine to the other and includes all tissues shown to and through the peritoneum. As a rule, only the recti are divided, but if the operation demands it the lateral muscles of the abdomen may also be cut. Bardenheuer recommends also turning down the upper flap of peritoneum and suturing it to the posterior pelvic peritoneum in order to protect the intestines from the field of operation. This is a very radical incision.

Pfannenstiel's⁷ incision is a transverse incision which has many adherents. Its chief value is based on cosmetic considerations. The scar of this incision is entirely concealed by the pubic hair. Postoperative hernia is supposed to be less common following this incision. Its important disadvantages are (1) very limited exposure, (2) time element, (3) greater tendency to wound infection. The technique of this operation is as follows. A straight or slightly curved transverse incision, three and one half inches in length, is made above the pubis, just within the line of pubic hair. The incision is carried down through skin, fat and fascia to the rectus muscle. The adhesions of the fascia to the linea alba are then cut away with scissors from the upper and lower fascial flaps. The recti muscles are separated by blunt dissection, as in the median incision, and the

peritoneum is cut longitudinally. Sometimes, for better exposure, the ends of the skin and fascia wound are curved upwards so that the recti muscles may be drawn more widely apart. Mansfield's modification of this operation differs very little from the original technique. A longer incision is suggested for more room.

Paramedian (right or left) incision gives a satisfactory exposure of the pelvis.

Bladder—(1) Transverse Incision. Kelly¹⁰⁶ has described a transverse incision above the symphysis of pubis for the exposure of the bladder. This is a modification of the Trendelenburg's¹⁰⁷ incision also advocated by Stoeckel.¹⁰⁸ A transverse incision is made through the skin, subcutaneous fat and deep fascia, about an inch above the pubis. The exposed recti are then pulled apart without cutting them. This exposes the space of Retzius.

(2) Vertical Incision. A midline incision is preferred by many surgeons for the exposure of the bladder, the lower angle of the incision being at the upper border of the symphysis pubis and from there extending upwards a variable distance depending upon the extent of the operation to be carried out. For simple exposure of the bladder two to four inches are usually sufficient. After passing through the skin, subcutaneous fat, and fascia, the anterior sheath of the rectus muscle is reached. A longitudinal incision through this in the median line will open up the space between the two recti muscles. As a rule, these muscles lie closely approximated so it may be difficult to see their respective borders, but by blunt dissection the line of cleavage can be found, and the muscles widely separated. The peritoneum and transversalis fascia covering it now appear in the upper part of the wound. Deaver¹⁰⁹ makes this incision a little to one side of the midline, exposing the sheath of the rectus muscle. The sheath is open and the muscle fibres are separated vertically with the handle of a scalpel. From their pubic attachment below, up to but not quite as far as the skin incision extends. Deaver thinks this lateral incision decreases the chance of permanent fistula formation, as the wound closes as soon as the drainage tube is removed. Postoperative hernia following this technique has been very uncommon in Deaver's experience.

Ureter—Extraperitoneal exposure of the lower ureter. The skin incision starts at a point above the level of the anterior superior spine, and one inch from it. From there it goes downwards and inwards, curving slightly upwards until it reaches the median line of the abdomen. The fascia of the rectus is divided transversely to the median line, and muscle splitting is carried out as in the McBurney technique. After retracting the edges of the internal oblique the fibres of the transversalis are exposed and separated. Care must be taken not to injure the peritoneum, which lies immediately beneath the transversalis fascia. By blunt dissection mesially, the peritoneum is then separated from the adjacent parietal wall of the abdomen and iliac fossa. The ureter is generally invisible but can be found by palpation upon the posterior surface of the peritoneum to which it is more or less loosely attached.

Transperitoneal exposure of the ureter. The ureter can be examined during the lower abdominal operations, but surgical work should only be performed extraperitoneally.

CASE STUDY

The author realizes the difficulty of making a comparative study of the various types of incisions from the small number collected here. It is in the form of a preliminary rather than a conclusive study that this report is made.

Five hundred and eighty-six cases of anterior abdominal incision have been examined to date, 336 of these occurred in the service of the late Dr. E. E. Vaughan of Chicago, whom the writer assisted, and 250 paramedian incisions in the service of Dr. Geo. de Tarnowsky and myself.

The cases examined are briefly outlined below:

Midline (supraumbilical)	36
Midline (infraumbilical)	57
Right Transrectal (Mayo, Mayo Robson)	43
Right Transrectal (infraumbilical)	38
Sprengel	17
Pfannenstiel	26
Kocher (R. paracostal)	18
Bardenheuer's incision	1
McBurney	100
Paramedian	250
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	586

(1) Midline (supraumbilical) Thirty-six cases with this incision were examined. Three had hernia in the lower angle of the wound. These cases were examined five to seven years after operation.

(2) Midline (infraumbilical) Fifty-seven cases operated for pelvic condition. In two cases of this group, the incision was extended two inches above and to one side of the umbilicus, resulting in a slight weak spot in the upper angle of the incision. Three cases showed slight weakness (hernia) in the lower angle of the wound. These cases were examined six to nine years after operation.

(3) Right Transrectal (Mayo, Mayo Robson) Forty-three cases with this type of incision were examined. These were all right-sided incisions and were used mainly for gall-bladder pathology. Atrophy of the mesial portion of the rectus fibres was marked in seven cases, and three cases showed slight bulging. These cases were examined three to six years after operation.

(4) Right Transrectal (infraumbilical) These cases were oper-

ated for appendicitis, out of thirty-eight examined, seven were drained. No large herniæ were found, but atrophy of the mesial portion of the muscle fibres ending in a weak spot was noticed in six cases. Two cases had slight bulging (drainage cases). Examination in these cases was made eight to nine years after operation.

(5) Sprengel's Incision. Seventeen cases examined were operated for gall-bladder and bile-duct pathology. Five resulted in a large hernia. Three cases had complete atrophy of the muscle and a marked weakness with bulging was noticeable. These cases were examined seven to ten years after operation.

(6) Pfannenstiel's Incision. Twenty-six cases were examined, in nine of this group the wound healing was very slow. Exposure in seven cases during operation was unsatisfactory. No herniæ were found. These cases were examined three to five years after operation.

(7) Kocher's Incision. Eighteen cases of right paracostal incision performed for the drainage of the gall-bladder. Though four scars were unsightly, no hernia existed. Examination in these cases was made seven to ten years after the performance of the operation.

(8) Bardenheuer's Incision. One case with this incision was examined. The operation was performed some twenty-five to thirty years ago. Severing of all the important structures of the abdomen transversely resulted in herniation of the whole abdominal contents. The patient wears a very tight abdominal support.

(9) McBurney's Incision. A hundred cases examined. Eleven patients in this group had appendiceal abscess, and were drained, one of them for nine weeks which was the only one resulting in fistula formation and developing a hernia. These cases were examined five to nine years after operation.

(10) Paramedian Incision. All cases with this type of incision were in the lower abdomen. So far, our experience with this incision in the upper abdomen is limited. Results in the lower abdomen have been very satisfactory. We are using this incision in the upper abdomen and though it is early to make a report, yet we are thoroughly convinced of its safety. In these 250 cases that have been thoroughly examined, one case of hernia in the upper angle of the wound was noticed. This patient developed an infection in the wound. These cases were examined two to five years after operation.

COMPARATIVE STUDY

It is not within the scope of this paper to discuss those cases of malignancy and infection where permanent anatomical damage of the abdominal wall is unavoidable. The incisions in such cases are of secondary consideration. The incisions for various hernia operations have not been included in this paper, as they require a special study by themselves. The great majority of cases for abdominal surgery are of the elective type. Good technique based on sound anatomical and physiological knowledge will minimize post-operative hernia.

All the abdominal incisions so far described may be summed up as of the vertical, oblique, transverse and combined types. All of these types have their advantages and disadvantages.

Vertical—Four types of incisions come under this group, and require consideration separately.

(a) The midline incision is made through the linea alba. This incision is performed quickly and easily, also it gives a very good exposure. No nerves are injured because the muscular fibres are not cut. It is also a bloodless incision. The linea alba is very highly differentiated connective tissue. The healing of incisions in this structure is very slow. Above the umbilicus the recti muscles are separated by an interval, so that their support in the line of incision is lacking, while the falciform ligament, which is often distended with fat, may carry the peritoneum from the median plane inward some distance from the abdominal wall. The recti muscles below the umbilicus are closely approximated and the peritoneum is thin. The midline incision through the linea alba gives one fascial plane to suture which is insecure, and leads to a diastasis recti. There is less tendency for hernia formation in the lower than in the upper abdomen. If the midline incision is chosen preventive measures against hernia formation should be used by the following method. The anterior sheaths of both recti muscles with the peritoneum are sutured together. The muscle with the anterior sheath from both sides should be carefully brought together with sutures.

(b) A transrectus vertical incision with separation of the rectus muscle fibres carries the danger of a permanent defect of the abdominal wall. When the rectus muscle is split in the direction of its fibres, it destroys the nerve supply of the medial portion of the

muscle If one nerve is destroyed, then a compensatory supply will result from the nerve branches above and below, and probably no interference will follow, but if there are two or more adjacent nerves destroyed, the mesial portion of the muscle will atrophy Sometimes when the nerve supply is destroyed during an incision, there may be a perfect healing for the time being, but later on there will be a loss of tone of the muscle involved This type of incision has a great disadvantage, it cannot be lengthened without the danger of cutting through important nerves Judd¹¹⁰ says, "Many times we are tempted to remove an adherent appendix through a right rectus incision, which was primarily made for gall-bladder operation but in doing so we may be obliged to continue the rectus incision several inches downward, severing one or more of the important nerves, which may cause the muscle to atrophy and lead to herniation A separate incision is necessary The advantage of this incision is that it exposes the organs to be explored without much retraction It still has many advocates in this country

(c) The pararectus is an incision through the linea semilunaris Battle's incision in the lower abdomen for the removal of the appendix is a good example of this type It gives easy and direct access to the appendix No muscle fibres are cut but the muscle is displaced inward and the posterior sheath and peritoneum divided in the line of the anterior sheath incision This incision has the great disadvantage that it cannot be legitimately extended without cutting the eleventh and twelfth thoracic nerves, so it gives a very poor exposure

(d) Doyen's vertical incision for the exposure of the liver, gall-bladder and spleen cuts the two oblique and transversalis muscles in the wrong direction and also destroys the important nerve supply of the abdominal wall

(e) Paramedian incision with lateral retraction of the rectus may be made in any part of the rectus sheath one inch from the midline The anterior rectus sheath is incised vertically to the required extent and the inner edge of the muscle is dissected free and displaced outwards The posterior sheath and peritoneum are divided in the line of the opening in the anterior sheath The incision may be extended from the xiphoid process to the pubis, without injury to the nerve or blood supply of the abdominal wall This incision

could be made on either side of the abdomen and with proper retraction all parts of the abdomen can be thoroughly explored After the peritoneum and posterior sheath are approximated the muscle slips back over the incision in the aponeurotic structure A. H. Southam and Professor Stopford¹¹² have followed up the results obtained by the paramedian incision with outward displacement of the rectus They found the sensory loss insignificant from the start, and the rectus on the side of the scar functioning normally throughout No weakness resulted after this operation My investigation of 250 cases of this type of incision strongly corroborates above findings The objection that is commonly raised against this type of vertical incision is the direction of the strain upon the abdominal wall This is a factor second in importance only to the avoidance of nerve injury An incision in the line of strain can be held together by proper suture until it is healed This incision is valvular in construction and approaches the anatomical and physiological ideal

Oblique —(a) Gridiron incision (McBurney) Two objectional features of this type of incision have been emphasized by some surgeons Occasionally a right inguinal hernia follows this operation owing to the damage to the last thoracic or first lumbar nerve This incision does not give sufficient room in some instances where further exploration is necessary

It is a muscle-splitting operation If care is exercised no nerve need be cut A direct access to the iliocecal angle and appendix can be gotten in this incision It is valvular in construction, that is, the superficial and deeper parts lie in different planes, and it is further safeguarded by the fact that each layer is incised in its line of strain. The incision can be extended by cutting the rectus sheath transversely with retraction of the muscle inwards (Harrington-Weir) This will give a very wide exposure Ventral hernia is very rare following this operation, even after prolonged drainage. The peritoneum may be closed by pursestring suture, leaving only a small scar on the inner surface through which the abdominal contents rarely adhere Rapid convalescence is another important advantage of this incision

(b) Oblique paracostal incision (Kocher) may be used on the right side for operations on the gall-bladder, and on the left for access to the spleen and cardiac end of the stomach Moynihan⁶⁴

finds this a very useful incision and feels that if a large skin wound and a small muscle wound are made and the nerves preserved, there is rarely a chance for a post-operative hernia. This incision is suitable for patients with a wide epigastric angle. Peet¹¹¹ has found this a most suitable incision in gall-bladder surgery and recommends its use with slight modification.

Transverse incision.—In the transverse incision the aponeurosis is divided in a direction transverse to the long axis of the body, and the rectus muscles are either displaced laterally or cut transversely to a greater or less extent or even completely.

(a) The Pfannenstiel incision has many adherents, its chief value being based on cosmetic consideration. The scar is entirely concealed by the pubic hair. Post-operative hernia is supposed to be less common following this incision. The important disadvantages are (1) Exposure is very limited (2) Takes much longer time in opening and closing (3) The wound has a greater tendency to become infected.

(b) Sprengel, Bakes and Moschowitz. One or both rectus muscles are divided transversely. This incision has been tried and highly advocated by a number of surgeons but never gained popularity in this country. After a thorough investigation Farr⁶ came to the conclusion that it is perfectly safe to divide the rectus muscle transversely. The advantages of the transverse incision are as follows: (1) It cuts the muscle without injuring any nerve (2) It allows satisfactory retraction of the cut edges, even where relaxation is very poor (3) The incision can be extended widely into the lateral muscles (4) In the vertical incision the lateral muscles pull in the line of the incision transversely while in the transverse incision there is hardly any strain on the sutures. Instances of hernia following transverse incision have been reported by many leading advocates of this operation. Some advocates of this incision found that it produces another linea transversa. The lineæ transversæ, do not penetrate the entire thickness of the rectus muscle but merely the anterior third or half, whereas the resulting scar from the transverse incision of the rectus produces a fibrous scar of the whole thickness of the muscle. A condition which does not simulate the normal transverse linea. During reoperation on three patients, who had had transverse incisions through the rectus muscle this was verified. Close

suturing of this incision may be followed by soundly healed fibrous scar for months and even years, but in time some stretching of the cicatrix takes place. Gradual weakening of the scar by stretching is quite a common occurrence. This incision is unsuitable in operations for septic conditions. "The rectus muscle has no firm fascial sheath, and holds stitches badly, so that dead space is often left in the line of incision, blood accumulates, and infection is likely to occur." Sloan⁴¹ has rightly said that the recti muscles are quite important structures of the abdominal wall, and that it is well worth while to preserve them, especially if their nerve and blood supply can be preserved intact.

In this country a transverse incision through the rectus is probably used less today than a few years ago.

Combined incisions have been described by various surgeons. Most of them are planned for the exposure of the gall-bladder region. The incisions of Perthes, Trinkler, Rio Branco, Czerny, Kocher, Kehr are seldom used in this country. It is questionable if those complicated incisions gave better exposure than the vertical ones. The result of nerve injuries and the injury to the various muscles has been fully discussed. The blood supply of the abdominal wall comes from three directions *viz*, upward, downward and laterally. The blood supply is very free and cutting any one of these vessels does not bring serious result, but if the blood supply from all directions is disturbed, infection and slow healing result. In these combined incisions the blood supply is seriously interrupted in addition to nerve and muscle injury.

CONCLUSION

From the general survey of the incisions presented in this paper with their variety of methods of handling the anatomical structures, it would seem the following are the pertinent points:

An abdominal incision should be of adequate size, so that the organs can be explored without difficulty.

The incision should not cut the oblique and transversalis muscle, but their fibres should be separated. The nerve and blood supply of these muscles can thus be preserved.

The vertical separation of the fibres of the rectus muscle destroys

the nerve supply of the mesial portion and produces a permanent weakness of the abdominal wall

The linea alba is very highly differentiated connective tissue. The healing of incisions in this structure is very slow.

A transverse incision through such an important structure as the rectus muscle is unnecessary. The resulting scar from the transverse incision of the rectus produces a fibrous scar of the whole thickness of the muscle, a condition which does not simulate the normal transverse linea. Gradual weakening of this scar by stretching is quite a common occurrence.

The blood supply of the abdominal wall comes from three directions, viz upward, downward and laterally. The blood supply is very free and cutting any one of these vessels does not bring serious result, but if the blood supply from all directions is disturbed, infection and slow healing result.

The paramedian incision with lateral retraction of rectus muscle and the gridiron incision meets all the requirements of the anatomical and physiological ideal.

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APPENDICITIS—RELATIONSHIP OF SYMPTOMS TO PATHOLOGY

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THE symptoms of appendicitis may be either subjective or objective. The subjective symptoms are the sensations perceived by the patient. They are discomfort, distress and pain and the special reflex splanchnic protective sensations—nausea and vomiting. The objective symptoms are observed by the examiner through the senses of sight, hearing, touch, smell and taste.

Since pain usually is the most insistent symptom in appendicitis, it is necessary to inquire into the mechanism of its production before we can thoroughly understand its relationship to the disease process. Sensation is carried from the abdomen and its contents by two great systems of nerves—the somatic and the splanchnic. The somatic nerves supply the body wall with sensation. The splanchnic (sympathetic) nerves supply the viscera. It is with the latter class that we are mostly concerned in our consideration of sensations associated with appendicitis. A further fact insistent in its importance is that the splanchnic nerves are chiefly concerned with function.

They are the principal means through which the vital functions of life are regulated. They do not have any pain fibres and therefore cannot carry pain sensation in the ordinary sense of the term. Therefore, the viscera cannot respond to disturbing activities with a local sensation of pain. To appreciate the reason for the lack of pain sensation in the viscera, it is necessary to remember that the splanchnic nerves have never in their biologic existence been disturbed by structural changes but are constantly involved in functional activities. Therefore, disturbed functional activity is the only adequate stimulus to induce protective reaction through these nerves.

Disturbed activity of the intestine, such as occurs in marked contraction (colic) or in over-distension, causes reactive disturbances in the splanchnic nerves. These disturbances induce impulses which are carried to the sensorium and are there interpreted in terms of sick feeling, nausea, etc., and may in certain cases, when the distress

is of great magnitude, been shunted over into the somatic nervous system and been felt as pain

mental pathological changes occurring in the appendix and the relationship of these changes to function, sensation and physical activities. The appendix is attached to the abdominal wall by a fan-shaped layer of tissue, the meso-appendix, which contains the blood vessels and the nerves. The free edge of the meso-appendix is generally concave and is not long enough to permit the appendix to be stretched straight without dragging on its free border, so that when the appendix is straightened as a result of inflammatory thickening, traction is made along the free edge of the meso-appendix. This traction in turn causes a dragging on the fibres of the sympathetic and of the somatic nerves distributed in the meso-appendix and pain is produced.

In appendicitis, in addition to pain, which is a sensory defense reaction, there are also aroused into activity functional defense reflexes. One of the principal of these is nausea, increasing to vomiting. Food entering the stomach increases intestinal peristalsis movement and functional activity which are deleterious in visceral inflammation. The principal result of the nausea-reflex is to restrict the entrance of food into the stomach and thus to inhibit the disturbing influence which food entering the stomach has upon the inflamed bowel. Therefore, nausea as a defensive-reflex acts by inhibiting the intake of food and vomiting reinforces this defense by removing food already ingested.

Minor disturbances in the appendix give rise to a slight nausea and do not cause vomiting but if there persists a continuation of the same degree of irritation, a summation of impulses results and vomiting follows. This explains the recurring attacks of vomiting in chronic appendicitis.

In acute inflammation of the appendix the vomiting usually comes on three or four hours after the onset of the pain. Relationship of vomiting to pain is very important in the differential diagnosis between acute appendicitis and visceral colic. In intestinal and gall-stone colic, vomiting occurs in association with the pain which generally is relieved by the vomiting. In peritonitis, the pain usually precedes the vomiting, which, after it once starts, becomes continuous. This is not the rule in acute appendicitis in which the primary pain is localized to the region of the umbilicus and is followed after a perceptible interval by the primary vomiting. This vomiting is

due directly to the splanchnic irritation and is a defensive reflex. After persisting for a short time, it ceases. There is an interval until the spreading inflammation involves the peritoneum, when a secondary vomiting, due to peritoneal irritation, occurs. The secondary vomiting usually follows, one, two or three days after the primary attack and is associated with an increasing tenderness and gradually progressing right lower quadrant rigidity, with an area of dullness in the same location. The pain of visceral colic is frequently confused with that due to appendicitis but is easily differentiated from appendicitis, if we remember that colic is always relieved by pressure upon the abdominal wall. This is best exemplified in gall-stone or ureteral colic when the patient clasps two hands over the abdomen and presses in deeply on the wall. In appendicitis, the exact opposite tendency is present, for the patient assumes a posture, which in my book on pain, I have termed "The peritoneal-reflex protective position." In this posture, one hand is placed over the abdomen as a defender and the other hand is used as a warding-off, defensive protection against anyone attempting to palpate the abdomen or to come into contact with it.

The changes and reactions noted above are essentially subjective, *i.e.*, they enter into the consciousness of the patient and are definitely and consciously perceived by him. The vast group of the other symptoms of appendicitis must be determined by the person examining the patient. They are defined by sight, touch and hearing.

The physical changes noted by sight are the position of the patient, the general appearance of the patient, the swelling in the right lower quadrant of the abdomen, immobilization of the lower abdomen with abdominal rigidity.

Position of the patient—The patient with acute appendicitis prefers to lie prone upon his back and usually has one (the right) or both knees drawn up. This is contrary to the posture assumed in colic where the patient may be sitting, bent forward upon his arms folded on his knees, by which pressure is made upon the abdomen. The patient with acute appendicitis lies quietly in bed and does not toss and tumble about as is so usual in those suffering from painful non-inflammatory lesions.

General appearance of the patient—Usually the person with acute appendicitis has an anxious, drawn expression. If the disease

has progressed to the point where generalized peritonitis is present, the patient has the well-known pinched and haggard expression, with furrowed forehead and anxious look—the so-called facies Hippocratica

The tongue of such a patient is a reliable index of the severity of the infection. Should it be moist, severe infection has not as yet taken place. The character of the tongue is one of the best indicators of the severity of the disease, a dry, crusted tongue indicates severe infection and when present a guarded prognosis should be given.

On inspection of the abdomen the extent of abdominal breathing and the ability of the patient to breathe deeply without great pain is of great diagnostic import. A painful peritoneal lesion will always inhibit the abdominal breathing and produce great pain on deep inspiration.

It may be noticed that there is an inhibition of breathing on the right side, particularly over the lower portion of the right rectus muscle. This is a sign of peritoneal irritation in this quarter.

A closer inspection may reveal that there is an indefinite swelling in this region. This swelling can be the result of a segmental contraction of the lower portion of the rectus muscle. Should a generalized peritonitis have resulted, there may be a marked swelling of the entire abdomen—the so-called balloon shaped abdomen, or the abdomen is hard and contracted, board-like. Balloon or board-like, bowel distension or collapse is the result of the absence or the presence of intestinal paralysis.

Abdominal rigidity is found in acute appendicitis and is a reflex motor activity induced in the abdominal wall by the peritoneal irritating lesion. It is an application of the law defined so many years ago by Hilton, in which he states that rest, which is the first prerequisite to cure in any inflammatory state, is induced by muscular rigidity which causes a splinting, as it were of the inflamed part. The reflex contraction of the segment of the rectus abdominis which lies over the inflamed appendix is the particular application of this law in appendicitis.

Abdominal rigidity is determined to a nicety by the palpating hand of the examiner which gently touches the abdominal wall. The reflex splinting is also manifested by restriction in the respiratory movement of the diaphragm on the affected side as well as by partial

or complete inhibition of peristalsis of the affected bowel. This "inhibition of peristalsis" is manifested by changes in the character of the peristaltic wave sounds. See page 203, also Relationships of Physical Signs to Acute Appendicitis by R. J. Behan, *INTERNATIONAL CLINICS*, IV, 38, 83, 1928.

Where the appendix hangs over the brim into the pelvis, abdominal rigidity may be entirely absent. This is frequently the case in a child. It may also be absent when the appendix is posterior to the cæcum and is totally walled off from the rest of the abdominal cavity. Both of these instances illustrate the fact that abdominal rigidity is usually a peritoneal reflex. The stimulus is carried first to the spinal cord and then is shunted out to the abdominal wall as a muscle stimulus with contraction of the wall. Even when the abdominal muscle-reflex is absent, there is, in the cases where the appendix hangs over the brim of the pelvis, a point of localized tenderness at McBurney's point. If the inflammation progresses and an abscess is formed, it may push down into the pelvis, make pressure upon the rectum and cause rectal tenesmus.

Tenderness—While determining the rigidity, the examiner's fingers also delimit the extent and the degree of local sensitiveness. This sensitiveness to touch is defined when the examiner makes light pressure on the abdominal wall. If the appendix is deep in the abdomen, the pressure required to produce pain must be marked. When abdominal pressure is made, it causes some change in the relationship of the appendix to the surrounding structures, so that traction is produced on the mesoappendix or the mesentery or there is compression of inflamed parietal peritoneum or increased intraluminary appendicular tension. Any of these is sufficient to cause pain. *In the appendix there are no sensory pain receptors, so that pain, when present, must be produced indirectly.*

Hyperalgesia present on light pin point pressure on the abdomen is the result of hypersensibility in the area of the skin under examinations. The area, usually associated with appendiceal irritation, is that of the maximum tenderness of the tenth, eleventh or twelfth thoracic sensory segmental distributions as described by Head. (See Behan's Pain pg 466, 515, 525)

If the peritoneum is involved, pain on pressure is always present. Should the involvement be localized, the pain produced by pressure

is localized to the area of peritoneal involvement. If the inflammation is diffused over the entire peritoneal cavity, the lightest touch upon the abdominal wall is productive of the greatest pain. A way to elicit hidden sensitiveness is to make pressure upon the wall with one or two fingers and then on suddenly releasing the pressure—greatly increased pain is felt.

Hearing is used by the examiner in the study of appendiceal changes. He defines and interprets the sounds produced by the changed peristaltic activity of the intestines. Normally, on listening over the right lower quadrant, there is heard two variations of peristaltic wave sound, *i e.*, the large wave sound and the small wave sound. The large wave sound, which is apparently the result of the contraction of the longitudinal muscle bundles, occurs once to every three or four small wave sounds, the cause of which is probably the contraction of the circular muscular bundles. When inflammatory changes take place in the intestinal wall, the proportional frequency instead of being one large—*i e.*, loud—wave sound to three or four small wave sounds, is one large wave sound to every twenty or thirty small wave sounds, or as the small wave sounds practically occur every second, *i e.*, one large wave sound in every twenty or thirty seconds. As the inflammatory process progresses, the large wave sounds gradually disappear and the small wave sounds become less frequent and as the inflammatory oedema involves the intestinal walls, they entirely disappear. When this occurs, there is an advanced state of inflammatory involvement of the intestinal musculature. Peristaltic wave sounds are useful only in estimating the extent of the involvement of the wall of the bowel in the inflammatory process and have no value in judging of the degree of inflammation of the appendix itself.

Hearing is also used in combination with touch, defining with more exactness the results obtained by percussion over the abdomen, particularly over the right iliac fossa. There is heard, normally, a resonant note of a particular and definite pitch.

In association with local tenderness and muscular rigidity in the right lower quadrant, an increase of pitch in the percussion note, usually in this portion of the abdomen, is an indication of an inflammatory reaction and this inflammation is usually associated with the appendix. In interpreting changes in the perc.

not be forgotten that rigidity of the abdominal wall alone will cause an elevation of pitch and a duller note. Localized high-pitched percussion sounds, *i e.*, dullness, should at once focus attention upon the area of the dullness as the most likely location of the pathology causing the patient's symptoms.

When this dullness is indefinite in outline and has ill-defined borders, it indicates that as yet there is no sharply delimited exudate or outpouring of serum, the inflammation is of a diffused type, without a marked infiltration and œdema of the intestinal walls. When a marked outpouring of serum, with a localized collection of exudate occurs, the percussion boundaries of the dullness associated with this collection are definitely determinable.

In association with the above objective physical findings, the following objective changes are important in the diagnosis of acute appendicitis.

1 Laboratory Findings—Of all the laboratory determinations, the white blood cell count is the most important. There is an increase of leucocytes with a gradually mounting polymorphonuclear differential proportion. As established by Sondern, most observers believe that the total leucocyte count is an indication of the patient's resistance, while the percentage of polymorphonuclears is an index of the severity of the infection. However, absolute reliance should not be placed upon the blood picture, as I have seen very bad, gangrenous appendices without much leucocytic increase.

2 The pulse rate is of some worth in evaluating the severity of the appendiceal involvement. The pulse rate is usually increased. When it is not increased and there are marked symptoms of acute appendicitis, the prognosis is very bad. It is also bad when there occurs a sudden increase in the pulse rate.

3 Stupor occurring in the course of an appendicitis is a bad omen. It indicates a spreading peritonitis, a rupture of an appendix or appendiceal abscess or the onset of complications as septic phlebitis, abscess of the liver, etc.

Retrocæcal Appendix—A retrocæcal appendix causes a variation in the symptoms but the essential diagnostic phenomena are the same. However, the dull note of retrocæcal abscess is modified by the tympany of overlying cæcum and the ascending colon. If forcible percussion is used, the dull note, *i e.*, the note of higher pitch is

brought into prominence Pressure of the pleximeter finger, if it can be borne, will displace the overlying cæcum, the dull note due to the underlying exudate is then more sharply defined The rigidity of the abdominal muscles lateral to the rectus is marked This in contrast to the absence of a marked generalized abdominal rigidity There is resistance to and pain is produced by hyperextension of the right leg The leucocyte, particularly the polymorphonuclear count, is high Elevation of temperature and pulse rate which is frequently present must not be confusing Pressure in the lumbar fossa is apt to be painful Sometimes a definite swelling may be seen on inspection This swelling bulges the lateral aspect of the right abdomen between the margin of the right costal border and the iliac crest Pressure in this area usually is very painful If the exudate is not too massive and the cæcal walls are not too extensively involved, peristaltic wave sounds may be heard when the bowl of the stethoscope is placed over the cæcal area If the inflamed appendix is in the pelvis, especially in children, the abdominal rigidity may not be so marked, and a rectal examination will disclose tenderness and ordinarily a tumor mass In the adult woman an inflamed appendix has been mistaken for a salpingitis or extra-uterine pregnancy, from the former, diagnosis is difficult but the triad of symptoms first, the pain, circum-umbilical, second, vomiting, a few hours after the onset of pain, then the cessation of the vomiting, and third, pain and tenderness localized to the lower right quadrant, point definitely to appendicitis

Appendicitis is apt to be confused with other lesions in the abdomen as

- (a) Colic intestinal, ureteral, gall-stone, uterine, and tubal
- (b) Perityphlitis
- (c) Kidney lesions ptosis with unreteral kink, pyelitis, nephrosis, hydronephrosis and pyonephrosis, perinephritis
- (d) Gall-bladder lesions

Appendicitis may also be confused with diseases outside the abdomen The element causing such confusion usually is pain which is present in the right iliac fossa The extra-abdominal diseases which may give rise to abdominal pain are lesions in the nervous system (meningitis), cord tumors, root pain in tabes, spinal ganglion disorders (herpes) or there may be an involvement of the intercostal

nerves on the right side Pain may be felt in the abdomen in heart affections as angina and cardiac dilatation The lung throws its pain reaction into the abdomen as is found especially in the right-sided pneumonia or pleurisy in children

OBSERVATIONS ON CANCER OF THE RECTUM WITH SPECIAL REFERENCE TO RADIUM THERAPY

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III

AFTER the discouraging reports contained in a previous paper, it is a genuine relief to examine some of the latest publications regarding radium therapy in cancer of the rectum. To be sure the outlook there displayed is by no means rosy, but at least there is so great an improvement over the earlier work that proctologists and others to whom rectal cancer is a very grave problem can take new courage.

Because they found the older methods of applying radium so ill suited to treatment of cancer of the rectum, European radiologists—the French in particular—for a time practically abandoned it. In 1925 the *Association française de Chirurgie* held a symposium on rectal cancer, and from the papers there presented one can gather what surgeons and radiologists alike had been doing during the intervening period. Schwartz and Richard reviewed irradiative treatment at length, explaining the reasons why the earlier work had been so uniformly unsuccessful, and relating in detail what had been done with the different forms of radiation therapy, Röntgen-ray alone, radium alone, or both together, either with or without conjunction with surgery. Their paper was but one of a long array devoted to the treatment of rectal cancer. The rest, for the most part, were concerned with surgery alone, but they represent a very wide range of opinion and practice, not only among French therapists, but throughout the world, as many of the participants were from countries other than France, and though no Americans were represented, so many statistics were quoted from American papers, that our own views and operative procedures were considerably in evidence. The findings of Tuttle, and many others, are reviewed at length. As the progress of rectal surgery is so closely bound up with any consideration of radium treatment, it may be well to pause

before taking up the details of the statements of Schwartz and Richard, and study the parallel efforts of their surgical colleagues. In all the papers, surgical and otherwise, emphasis was laid, not so much on methods of treatment, as upon the *final results* of those methods.

Extirpation by the lower route was the theme of H. Gaudier's communication. He states that his figures are based upon the reports of Miles (56 cases), Turner (53 cases), Lockhart-Mummery (65 cases), Lynch (335 cases), Mayo (430 cases), Montague (87 cases), Mandl (508 cases), Pauchet (280 cases), together with those of Mondor and Chaher, Burgess, Ch. Ryall, H. Brown, Malolay, Nicolaisen, Gant and J. Boeckel, the number of whose cases is not mentioned. The total number of cases thus marshalled is about 2,400, 25 per cent. of which were operated by the perineal route, 35 per cent. by excision of the coccyx and 40 per cent. by the sacral route. The least operative mortality authoritatively recorded was 20 per cent., in some reports it was as high as 30 per cent. and claimed by others to be no more than 4.5 per cent. In round numbers, over the entire series, 20.5 per cent. of the patients were well without recurrence, three years after operation was done. In the author's own series mortality was 20 per cent. for the perineal route, and 16 for the coccygeal, or about 18 per cent. for the entire series.

The sacral or dorsal route is not used in France at present as often as formerly, but it is the operation of choice in Germany and finds favor with many English and American surgeons. By its use, the operative mortality which before 1900 ran from 22 to 32.5 per cent., dropped as low as 17.4 per cent., and an equal improvement in ultimate results was noted. After three years 32 per cent. of the patients were alive, after five years 26.2 per cent., and after eleven years 19.5 per cent. were still without recurrence, in some of the cases well advanced in age, though it is later on stated that more than 80 per cent. were less than fifty-five years old when the operation was done.

It is remarked that this matter of age must always be taken into consideration in the history of any post-operative case, not so much from the point of view of resistance as of the appearance of intercurrent maladies due to senility, or to which advanced age predisposes. Though actually age constitutes no barrier to operability, only the state of the malignant lesion being of importance, age must be

reckoned with as reducing the length of time the patient can possibly survive. In the very old any procedure can be regarded only as palliative. Of patients of any age a cystoscopic examination will often reveal a condition in the bladder which makes operative interference in the rectum inadvisable, and this is more likely to be true as age advances.

The result of operations merely intended to be palliative was also considered in this series. Chief among these is the establishment of an artificial anus. The results from this vary directly as to whether the intervention was undertaken when occlusion was imminent or had already occurred, or was done in anticipation of interference with rectal excretion. Vanverts did colostomy upon seventeen patients, two, who were operable, survived for more than three years, and of those completely inoperable so far as the rectal lesion was concerned, one survived three years, and two others for more than four years. Gaudier himself had one diabetic patient who lived six years after the artificial anus had been made as the only possible relief for rectal cancer, but none of his other patients so treated lasted for more than two years. Uniting all his figures, he found that since the year 1900, of 480 cases, there remained alive. After three years, 26 patients (5.3 per cent.), after five years, 16 patients (3.3 per cent.), after ten years, 4 patients (0.8 per cent.)

Of these 480 cases, 413 were regarded as wholly inoperable. Of these only six survived three years, the remaining twenty were all able to later undergo radical extirpation of the rectal lesion. The figures reported by Mandl from Hohenegg clinic are somewhat better than these. In that clinic colostomy is regularly done in all cases of rectal cancer deemed capable of palliation or attempt at cure. Of 184 thus given treatment, 150 operations were regarded as entirely palliative, while the remaining 34 were performed as the first step in the radical operation upon the rectum. In these the rectum was not opened until the third or fourth day after colostomy. The immediate operative mortality was about 12 per cent. After three years 5 per cent. of the patients were still alive. Other cases of rectal cancer cited by Mandl are recorded as living after nine and twelve years respectively. It is notable that when survival is as long continued as in the cases just cited, the patients have usually learned to live in comfort with the artificial anus. Often it becomes almost

as continent as the normal opening, and by selecting a somewhat constipating diet, it is possible in some cases to develop an "announcing sense" in the nerves in the portion of the intestine near the colostomy opening, permitting voluntary evacuation in an approximately normal way

There seems to be no doubt that metastasis is more frequent, either early or late, after palliative operations than after radical intervention—that is, amputation of the rectum, or resection. When the three-year period has elapsed metastases are recorded as the most frequent cause of death, making at least two-thirds of the total mortality. The questions connected with remote mortality were especially studied by Schwartz who pointed out that the mass of evidence and long arrays of figures relating to rectal cancer now show us, all too plainly, that we cannot consider a patient cured because he has gone for three years without recurrence. Even though many surgeons have brought forward patients who have survived, ten, fifteen, twenty or even more years, we have also seen recurrences after ten years or longer. In the statistics of Lagoutte (Creusot) there is recorded a case where a generalized carcinomatosis took place after thirteen years of apparent good health, Gouilloud of Lyon mentions secondary invasions after four, five and six years, while Tixier of the same centre had two recurrent cases after a three-year interval. Riche, in a personal communication informed this investigator that he had a case of recurrence *in situ* after twenty-six years!

The attention of Schwartz was centred chiefly upon the remote results obtained in France from the removal of rectal cancer by the abdominal or the combined route. He gathered an immense amount of material, most of which we have already discussed in preceding paragraphs. He attributes the gradual decline in the immediate mortality of the operation, which is very striking when one compares the figures collected by Mondor and Chahier for the later years of the nineteenth century with those appearing in the literature of the decade immediately past, not so much to increased skill in coping with rectal cancer, as to a better selection of cases suited to operation. It would seem that although rectal cancer is diagnosed much more often than it was twenty-five and thirty years ago, the number of operations has showed no corresponding increase.

The employment of palliative measures—especially the artificial anus—is more in favor than in the past, and the operators who are able to give out the lowest mortality rates accomplish this by employing radical extirpation upon a relatively few cases, selected by decidedly rigid tests. Abdomino-perineal excision of rectal cancer does not appeal to Schwartz as being an excessively hazardous procedure, he can only account for the very high mortality admitted by some surgeons by supposing carelessness in selecting risks. This, he believes, enables surgeons to put forth such optimistic reports as that of Jocelyn Swan, who gave an account in the *British Medical Journal* for 1920, of the performance of 11 operations without a death, of Brin, whose mortality was 14 per cent, of Quenu who did 11 operations during the war, with but a single death (and that in a woman already exsanguinated by repeated hæmorrhage, a risk most surgeons would have refused without hesitation), or of his colleague Cuneo, who did 11 operations with but one death. These figures would seem to prove that the combined method in certain hands with all factors carefully controlled, becomes a relatively safe procedure. But to successfully practice an abdomino-perineal operation for cancer of the rectum requires not only an operable lesion, but thorough mastery of the technique used. It is necessary to know the anatomy of the organ in question—its points of fixation, its relations to other adjacent organs, the disposition of its vascular supply, and the planes of cleavage by which they may be freed. Long study on the cadaver must precede any attempt to carry out the procedure upon the living subject. To learn how to do the operation properly, and then to perform it only upon operable cases—these are the prime requisites to success.

This rigid criterion upon operable cases has, however, one grave disadvantage for the surgeon. He must make some provision for the numerous sufferers to whom operation has to be refused. Therefore, despite the disrepute into which radium seemed to have fallen when considered as a means of combating cancer of the rectum, Schwartz was obliged to have recourse to it, and his practice has been followed by many Continental surgeons, even though their reports gave little evidence that they had any faith in it. In the review of European work with radiation—both radium and X-ray—we can plainly discern a gradual revival in interest in this branch of rectal

cancer treatment, and a steady extension of its employment, even in those quarters whence the most vigorous arguments against it formerly issued. The paper by Schwartz and Richard opens with a statement of two facts which struck the authors most forcibly when they began to gather material for its preparation. In the first place, the relative rarity of publications upon this subject, in comparison with the vast array of literature relating to the treatment of cancer of the cervix uteri by radiation. In the second place, the small number of statistics, most of the authors devoting their attention to the technical employment of radium or X-rays, and omitting to give any precise account of the ultimate results they succeeded in obtaining. Moreover, the great variety of methods of application, added to the paucity of reports and scarcity of remote outcome figures, led inevitably to the conclusion that in cancer of the rectum we have to deal with a neoplasm essentially radioresistant, and from the outset peculiarly difficult for the radiologist to overcome. While one may hope that cancer of the rectum may in the future yield to radiation when better methods have taken the place of those now in use, just as has already taken place with cancer of the tongue, *at present*, definite curative results are the exception rather than the rule, and we can look upon radiation only as an adjuvant to surgery, very helpful as such, but incapable of accomplishing much more than limitation if used alone.

Though we have already cited the conclusions of Schwartz and Richard (INTERNATIONAL CLINICS, 39th Series, Vol I, p 141), it is of interest in connection with my own experiences which are to be detailed further on, to summarize their findings in regard to the different methods of radiation employed in the treatment of rectal cancer since this same therapy had achieved so signal a success in malignancies of the female generative organs. Though the causes of non-success were "multiple," they felt they could be reduced to the following:

1. The chief factor is a narrow margin of radiosensibility. The meaning of "margin" they define as the difference between the minimum dose capable of destroying the normal tissues (necrosing dose) and the minimum dose efficient to destroy the neoplasm (cancericidal dose). The greater this difference, the easier will it be to obtain a cure, if the difference is zero any effective treatment by radiation

is impossible In cancer of the uterine cervix we are dealing with a radiosensitive neoplasm developing upon a mucosal surface markedly radioresistant Here the "margin" is a wide one. In cancer of the rectum, on the other hand, the neoplasm is radioresistant and the rectal mucosa relatively radiosensitive The "margin" is very narrow, though by no means nonexistent

2 The anatomical location of the growth is a second limiting factor Clinical examination, even with the aid of the proctoscope and of roentgenography, can never be as complete and exact as that possible when the uterus or its adnexa is the site of the malignancy, wherein vaginal palpation, or rectal investigation enables one to ascertain the extent and condition of the growth with great exactitude, a very important point in determining the conditions for a satisfactory therapeutic radiation The upper limit of a rectal cancer can never be exactly determined, whereas it is possible to illuminate the uterine cavity completely and determine precisely how high the area of radiation should extend, and to keep it within a definitely predetermined limit. The number of methods proposed for limiting the upper extent of a like lesion in the rectum, as well as those put forward for maintaining radioactive centres in proper position after inserting them into the rectum, gives ample evidence that no satisfactory technique has yet been agreed upon, as is now the case with cancer of the uterine cervix.

3 The arrangement of the lymphatic system of the rectum is another drawback to successful radium therapy When the superior hæmorrhoids have been invaded, especially that group lying at the bifurcation of the superior hæmorrhoidal artery, a situation extremely difficult to cope with, will have arisen. These glands are so far from tubes of radium placed in the region of the original neoplasm in the lumen of the rectum, especially if the lesion be located in the ampulla, that any efficient radiation of them is impossible It is quite otherwise with the lymphatic glands of the parametrium, which are only an infinitesimal distance from the lateral cul-de-sac of the vagina

Yet though these difficulties are very serious, ill success is undoubtedly still more often due to technical errors, the most common of which are Insufficient filtration against both primary

and secondary caustic rays, and too short periods of application, some therapists keeping their applicators in place but a few hours

With all these drawbacks, however, radium has provided a very efficient palliative for cases where surgery was out of the question, either when the lesion was first seen, or for post-operative recurrence. As a proof of this may be cited the report made by Quick in 1921 on 161 cases treated by Janeway's bare-tube methods. In most of these patients a considerable degree of palliation was obtained, as indicated by diminution or complete cessation of pain, stoppage of offensive discharge and disappearance of hæmorrhage. Sometimes this amelioration endured for two or three years. In fourteen cases there was complete clinical cure dating from five months to five years. All this was accomplished without any kind of filtration against the caustic beta rays.

The success attained by the bare-tube method emboldened the French therapist Cesbron to replace the tubes by platinum needles filled with radium or its emanation (Regaud needles). Rubens-Duval and Oppert used this method upon fifteen patients, seven of whom died within 18 months of treatment. Of the eight patients remaining alive after 18 months five were not cured, but remained under treatment for one, two, and two and three-quarters years respectively. Three patients were clinically cured for one, two and more than three years.

In the United States, Kelly of Baltimore developed a slightly different technique. He used filtered tubes arranged in "chaplets," that is placed end-to-end, and reinforced the radiation thus obtained by placing four surface applicators, similar to the "radium pack" upon the external surface of the sacrum, coccyx, perineum and pubis, each applicator retained in position until it had delivered 75 millicurie hours of radiation. Kelly's report covered 200 cases, 22 of which he claimed as cures. Of 94 cases treated by radium alone (90 of them entirely inoperable) there were 8 per cent. of cures. In some of these only external applicators were used. From external applications alone, he obtained but 6 per cent. of cures, but when the external and intrarectal were combined the percentage rose to 11. With radium used after surgery, in 58 cases, 21 of which had proved to be inoperable when exposed, he obtained 17 per cent. of cures. Considering only the operable cases, six were treated by

radium after surgical excision Three of these patients survived for more than five years The three deaths were due, one to operative shock, and two to recurrence of cancer, two years and three years after treatment

It is probable that the work of Kelly had a considerable influence upon that done somewhat later by Neumann and Coryn in Belgium Their plan was first put forward in December 1924, and the method then advocated is, at present, the most widely used way of applying radium to rectal cancer in nearly all parts of Europe

Neumann's method is termed "combined," but must not be confused with the surgical procedure for the relief of rectal cancer which also bears that designation Here the combination is of two different agents—surgery and radium—while the other is a combination of two different surgical approaches The first generally circulated description stated that the method's first step is the establishment of an artificial anus This is regarded as a *sine qua non*, inasmuch as the subsequent radium treatment frequently causes so much contraction of the rectal walls as to completely occlude the lumen As they phrase it, "Rectal stenosis is the rule" The patient rests for eight days after the artificial anus has been made After that amount of time has elapsed the excretory canal has become habituated to its shortened course and the patient will be over the immediate effects of the surgical procedure, so that the main intervention can be carried out This consists of resection of the coccyx in the median line, the anus being closed beforehand as in the Kraske procedure This provides wide exposure of the rectum, usually making it possible to palpate the entire malignant growth, thus doing away with the second of the objections to radium treatment of the rectum cited by Schwartz All relations to surrounding organs—prostate in the male, vagina in the female, or bladder in either sex—can likewise be readily determined and any possible malignant affection easily noted

With the rectal malignancy in plain sight, a radium *barrage* is now set up Platinum needles, 3/10 millimetres thick, carrying 0.6 milligrams of radium element each, are passed through the healthy tissues surrounding the lesion, spaced from 1½ to 2 centimetres apart. Care is taken to keep the needle points from piercing the rectal mucosa, only the muscular tissue being entered When

in position, these needles are at a tangent to the rectal ampulla. A second set of needles, of less capacity—from 0.6 to 1.33 milligrams of radium element—are next placed directly in the malignant tumor, passing entirely through it, and so spaced as to give a like amount of radiation to every part of the growth. So far as I have been able to discover these authors do not provide any extra radiation for the group of lymphatic glands which Schwartz and Richards cited as especially prone to develop metastases—that is, those at the bifurcation of the superior hæmorrhoidal. In their first paper they mention their intention to do this in the future, however. The entire dosage used at present is from 48 to 60 millicuries destroyed.

Great claims have been made for this procedure. The reaction is said to be slight or nonexistent, and healing very prompt, usually taking place within a month. If there is a persistent discharge it is usually deemed wise to perform amputation of the rectum with additional deep X-ray therapy, some two months after the insertion of the radium. This third surgical procedure is said to be well borne even by old and feeble subjects. From 1922 to 1924, 40 patients received this treatment. Eleven of these are dead, four from the immediate effects of operation, and seven from recurrence. From their two-year experience—too short a period to make any definite claims—Neumann and Coryn reckon 52.4 per cent of cures, in a series of which 70 per cent of the patients were inoperable by accepted surgical standards.

This technique was joyfully accepted by surgeons and radium therapists in many parts of Europe. In this country and England it has never received any particular attention. Writing in 1927, R. Proust, who was one of the few French surgeons who never lost his faith in the ability of radium to cure rectal cancer, states: "The results furnished by needling according to the technique of Neumann and Coryn on the one hand, the persistence of the cure achieved upon patients considered as inoperable and therefore ineligible for secondary operation, on the other hand, confirms the opinion formed by Quick's statistics that radium puncture of a rectal neoplasm is superior to, and much more efficacious than, the simple application of tubes to the lumen of the rectum. It is another impressive demonstration of a principle well-established in curie-

therapy that many centres of relatively small power are necessary to effect a good homogeneous radiation of any given neoplasm ”

Proust has always maintained that no radium treatment of rectal cancer can be of any value unless preceded by the establishment of an artificial anus. And he feels that only cases inoperable by well-recognized standards should be given radium treatment, reserving this for those cases to which no other aid is possible. He emphasizes the opportunity which the wide exposure advocated by Neumann and Coryn gives for complete sterilization of the retro-rectal tissue. “If Kraske’s operation, in spite of all its faults, has finally succeeded in producing relatively stable results, it is solely because those using it can excise more retro-rectal tissue than by any other procedure. Inasmuch as Neumann’s methods can be employed for extensive sterilization of this tissue, it has made important progress toward supplanting this hazardous operation, although it cannot yet be said to be on a par with it. At present, it offers a chance of better mobilization of the rectum for radium applications and lessens the changes of pelvic cellulitis by sterilization of the rectal canal, already lessened by the establishment of the iliac anus ”

What appears to be an unbiased view of the true merits of Neumann and Coryn’s method, was published less than a year ago by R. Gauducheau of Nantes, who had used the technique for a two-year period, during which he treated thirteen subjects of inoperable cancer of the rectum. Previous to using the method he had gone to Belgium and personally assisted—though perhaps only in the French sense—in its application by its originator. He followed Neumann’s injunctions except in the matter of intervals between the three steps of the procedure, allowing not less than three weeks between the establishment of the iliac anus and the insertion of the needles, and an indefinite interval before the final amputation of the rectum. He italicizes his conclusion that the method finds its strongest indication in the ampullary and posterolateral forms of rectal cancer. To reach the groups of lymphatic glands along the superior hæmorrhoidal vessels both superior and inferior, 1-milligram needles are introduced both within and without the ampulla, directed toward these gland groups. As he has used this technique but two years it is too soon to tell whether this method for control of glandu-

lar metastasis will be permanently effective. So far it seems to work exceedingly well.

The drawbacks to Neumann's method are summarized by this author as follows:

1 The possibility of serious hæmorrhage when the needles are withdrawn. Several of the Belgium therapists' patients have died because of this. Gauducheau himself narrowly escaped losing a patient in the same way. In his own case he now believes he put the needles too closely together, and he has since avoided this complication by spacing them more widely.

2 The slowness with which the wound closes is a not inconsiderable objection. The lower part, near the anus, closes in three to five weeks, but the upper part, on a level with the resected coccyx, has continued to discharge for six or even twelve months in some of his cases. When the third stage—excision of the rectum—is carried out, this does not matter so much, but on patients completely inoperable, it is a very grave objection.

3 Frequently during the second month after needling, the patient undergoes attacks of most severe pain which persist from one to six months. They then disappear, but not always completely. Apparently these painful periods correspond with the phase of rectal sclerosis following radiation, and are due to attrition of the nerve fibrils. Complete ablation of the entire zone, will, of course, obliterate them. Gauducheau tabulates his cases according to years:

1926 5 cases: two dead of cancer before one year elapsed, one woman had prolonged pain, but her present condition is satisfactory, two have recurrence at the site of operation.

1927 6 patients: one died of fulminating alcoholic hæmatemesis after leaving the hospital, one died of the effects of cancer, the remaining four are in satisfactory condition.

1928 2 cases: operated in January, 1928, their condition is so far satisfactory.

No conclusions can be drawn from so small and recent a series, but for inoperable cancerous lesions of the rectal ampulla the author thinks this technique well-adapted, particularly in cases where the formation of the iliac anus has failed to give full measure of relief. It can certainly be said that its palliative effects are excellent, and

when it is practical to perform the third step, that is, amputation of the rectum, the painful period can no doubt be completely obviated

In the United States we have heard little concerning the combination of radium and surgery in the treatment of rectal cancer. The most recent authoritative pronouncements on the subject of rectal cancer and its treatment by radium are those of Binkley of the Memorial Hospital (New York), appearing last November, and that of Jones of the ill-fated Cleveland Clinic, which was published in February of this year. Binkley does not indulge in many figures. His paper is mainly a plea for the wider use of gold-filtered implants. "Interstitial application by gold emanation seeds is the most efficient method of supply adequate irradiation to radioresistant rectal cancers." At the Memorial Hospital such implantation is often followed by removal of the devitalized mass by surgery ten days or two weeks later. Pre-operative radiation is regarded as more logical and effective than post-operative applications. Radium has proved most useful in giving palliative treatment to patients for whom no surgical relief was possible. This has sometimes been in the form of external applications only, more recently this has been combined with gold-seed implantation. "Favorable cases receive within a few weeks sufficient intensive applications to cause the disappearance of the tumor, the unfavorable group is given smaller doses."

Sixty-five cases are considered in the Cleveland Clinic report. Of these 12 were operable, but the patients refused surgical intervention. The rest were unfitted for surgery. All had been treated not less than two years before the report was made. Colostomy was done in 57 cases and was earnestly advocated for all. Ten patients were clinically cured, and in two of these it was possible to close the colostomy opening. These patients have been well for five and six years respectively. Tubes, needles and implantation of gold seeds were all employed for radium application, in 45 of the 65 cases additional X-ray treatment was given, eight of the ten patients who have remained clinically cured, having been treated in this way. Of the entire series 15 per cent have remained well over periods varying from three to seven years. The general impression gained from this report is that radium, while not offering the same chance of cure that surgery does, has yet a wide field of usefulness in palliation,

and may be counted on in some cases to effect as complete a cure as surgery can accomplish

My personal experience with radium as a therapeutic agent in cancer of the rectum now extends over a period of eight years. In common with the workers whose attempts to make radium of service in this form of malignancy have been under review, I have experienced much discouragement, especially in the earlier days when it was impossible to obtain suitably filtered applicators for use in a region so highly radiosensitive as the rectum. With the introduction of screened radium implants, which became obtainable in 1926, my results have improved, but sufficient time has not yet elapsed to enable me to make any deductions as to final results. More than any other malignant lesion, rectal cancer is subject to long periods of quiescence, and it has already been shown how long a time may elapse, yet in the end active recurrence will be in evidence.

In my opinion, however, radium in combination with colostomy, or even in certain cases without it, gives the greatest hope of palliation in clearly inoperable cases, and on the whole, I feel that the claims made for it have been repeatedly justified. *Cure* is at best a relative term. A patient far advanced in years may be made comfortable, and his rectal cancer so far regress as to lead both patient and physician to believe it permanently inhibited. When he succumbs to a terminal pneumonia, or other malady to which his advanced age makes him peculiarly liable, should we be fortunate enough to obtain an autopsy, the chances are we will find he still has his rectal cancer, but its condition is not much advanced beyond that which it presented at the conclusion of radium treatment. In other words, while I do not believe we often succeed in doing away with the rectal growth altogether, it is evident that we are able to inhibit its active proliferation, cut off the demands it is making upon our patient's general stock of physical resistance, and give him a long respite from the horrors of active malignancy, often a long enough respite to permit him to die of "old age," or at least of some affection other than rectal cancer. And such an outcome of radium therapy I consider abundantly "worth while."

Because of conditions which were discussed at length in earlier pages, cancer of the rectum does not often come into the hands of the surgeon until it is well advanced. All too frequently when first

seen it is quite inoperable. Consequently, the rectal surgeon continually finds himself confronted with the problem of handling these inoperable cases, and if conscientious, he will be most anxious to find some other means than the ever-increasing dosage of narcotics. I have now under my care a number of individuals who fall into this class. At periods of varying length they have been given radium treatment, some have become habituated to the artificial anus, and are comfortable and apparently in excellent health several years after their latest treatment. Careful attention must be given to diet, and most of these patients are obliged to lead the lives of invalids to a great extent. Yet a few are actively engaged in business, some women can carry on their household duties practically as well as before the initial appearance of the rectal lesion, and this despite advancing age.

By no means are all of these patients old, far advanced rectal cancer is very often met with in the fifth and sixth decade of life when the victim has just attained the zenith of his usefulness. Clinically, we know that such lesions offer a less hopeful prognosis at this age than do those presented by subjects past sixty or even seventy. Nevertheless, I have seen prompt regression of the rectal lesion after the establishment of the artificial anus and radium applications, either by implantation or otherwise. I feel that the radium therapists have shown a somewhat mistaken zeal in seeking to establish the preeminence of radium over surgery as a means of cure of cancer of the rectum. Cures of this disease, no matter what the therapeutic means employed, have been lamentably few. While we should not relax our efforts to find a means of accomplishing complete removal, we ought not to overlook the great need of those patients for whom no hope of such cure can be held out, for they far outnumber those of the first class.

The fourth and final paper of this series will be wholly confined to suggestions as to the care and comfort of inoperable cases of cancer of the rectum.

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PHRENIC NERVE OPERATIONS AND CHEST SURGERY IN THE TREATMENT OF PULMONARY TUBERCULOSIS*

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BEFORE taking up the subject of compression therapy in the treatment of pulmonary tuberculosis, it must be thoroughly understood that only through active cooperation between the physician and the surgeon, is it possible to select patients for operation properly, and to avoid bad results as far as morbidity and mortality are concerned. As a rule, the patient should not be subjected to compression therapy when first seen by the physician, but should be placed in a sanatorium for a period of at least several months. During this time, if the physician finds that the chances of a medical cure are not reasonably good, and that what tuberculosis is present in the better lung would not be harmed by compression therapy, and that the patient's general condition is satisfactory, then only, should this form of therapy be considered.

MEANS OF COMPRESSION THERAPY

The means of compression therapy at our disposal may be divided into two main groups—*first*, artificial pneumothorax which may have to be supplemented by a phrenic nerve operation, extrapleural pneumolysis, or intrapleural pneumolysis by the closed method, and *second*, extrapleural paravertebral thorocoplasty which may have to be supplemented by a phrenic nerve operation, extrapleural pneumolysis, intrapleural pneumolysis, or parasternal thorocoplasty. It is only after unsuccessful attempts at the induction of artificial pneumothorax, due to extensive pleural adhesions, or after incomplete compression, due to one or more smaller adhesions, that has not been benefited by some of the supplemental procedures, that one is justified in undertaking the more formidable operation of extrapleural paravertebral thorocoplasty.

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HISTORY OF COMPRESSION THERAPY

While compression therapy has come forward only during the last few years, it must not be thought that this is a new procedure. In reviewing the literature, we find that in 1821, James Carson first urged artificial pneumothorax in a treatment of lung abscess and pulmonary hæmorrhage, but it was not until 1882 that Forlanini first used artificial pneumothorax. Cerenville, after observing the favorable influence of pleural effusions and spontaneous pneumothorax on unilateral pulmonary tuberculosis, in 1885, performed the first thorocoplasty in order to compress cavities in pulmonary tuberculosis. Brauer was the first to realize that clinical success depended upon obtaining pulmonary compression somewhat comparable in the amount with that obtained by artificial pneumothorax, and in 1907, Frederick carried out these ideas by removing the ribs, periosteum, and intercostal muscles, over the diseased areas. Phrenicotomy was first done by Stuertz in 1911, extrapleural pneumolysis by Tuffier in 1891, and intrapleural pneumolysis by Jacobæus in 1913.

CHANGES IN THE COMPRESSED LUNG

Tuberculosis in any part of the body heals by fibrous encapsulation, and in order to bring this about, it is necessary to raise the individual resistance of the patient by environmental conditions, and perhaps, by tuberculin therapy. Rest plays probably the most important part in the treatment of pulmonary tuberculosis, and whether this rest is obtained by natural or artificial means, depends entirely upon the extent and location of the lesions as well as upon the individual resistance of the patient. Enforced idleness, or bed rest, reduces the number and the depth of the respiratory movements, but it cannot put the lung at complete rest and by no means does it protect against the violent movements of coughing. Respiratory movement is largely responsible for the movement of pulmonary lymph. After the lung has been placed at rest there is a cessation of the flow of this toxin-laden lymph into the general circulation and the bacilli-laden lymph to new locations in the pulmonary area. This is shown by an improvement in the patient's general condition, and by a drop in temperature nearly approaching normal.

Amieulle has called attention to the ease with which bronchial contents are transferred during hard coughing, from the base of one

lung to the base of the other, neither of which has been compressed. Pulmonary compression obviates the danger of the transportation of infected material to new fields in the bronchial tree, as well as reducing the amount of bronchial secretion produced—thus lessening the tendency to cough and the danger of aspiration of infected secretions into either lung. After compression therapy, there is a lessening in size of the cavities, ulcers, and other tuberculous lesions, and of the alveoli and small bronchi. Accumulated products of the lesions and bronchial catarrh are emptied from the lung fields as well as the tubercle bacillus carrying secretions—thereby removing one of the most dangerous sources of infection in advanced tuberculosis.

With the reduction in the amount of loose exudate and semisolid masses, there is a marked decrease in the amount of inflammation present, and a reduction in the amount of waste products formed. This is clearly shown by the lessened amount of sputum following the different forms of successful pulmonary compression. While strong compression flattens only the smaller and medium sized bronchi, the larger bronchi are occasionally closed by new fibrous tissue which works in between the mucous membrane and the cartilage, and fills their lumina. Cuboidal epithelium lines the alveoli and their lumina and those of the smaller bronchi which become filled with desquamated epithelium and mononuclear cells of endothelial origin. Cavities, whose walls are not very stiff, are obliterated to mere clefts by compression therapy. The compression itself accomplishes part of this, but the secondary fibrous tissue shrinkage accomplishes far more. The compressed cavities fill with granulation tissue rich in blood vessels and become obliterated, or a smooth, clean mucous membrane replaces the previous dirty lining. At this point, I would like to impress that the beneficial results obtained by compression therapy, are not directly those of the compression from without, but are those obtained by the shrinkage of the newly formed fibrous tissue, within the lungs. This is clearly demonstrated by observing a patient who has had one of the forms of operative therapy, and noting that the amount of compression obtained, is greater months after the immediate beneficial results of the operative procedure are apparent.

METHODS OF COMPRESSION THERAPY

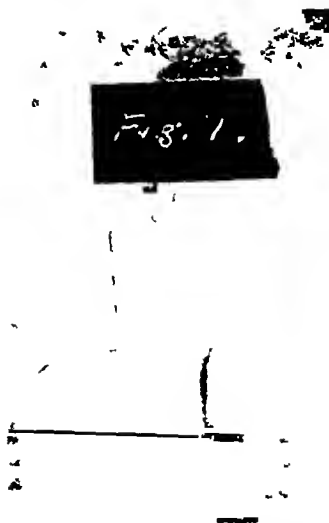
Artificial pneumothorax is the simplest means at our disposal, and when it is possible to obtain a complete compression, it is far greater than that which can be obtained by any operative means. However, this simple procedure is fraught with dangers which cannot, and must not, be overlooked or disregarded.

Phrenic nerve operations result in the diaphragm rising into the chest, and are particularly indicated in cases with marked diaphragmatic irritation or adhesions, as well as in lower lobe cavitation, or as a preliminary to a paravertebral thorocoplasty. Thorocoplasty removes sections of the ribs, permitting the fibrous tissue within the lungs to shrink, and to continue to shrink, to the limit of its capacity. As a result, the tuberculous lesions within the lungs are tightly squeezed, inclosed by fibrous tissue walls, and rendered inactive.

ADVANTAGES OF ARTIFICIAL PNEUMOTHORAX

Artificial pneumothorax has the advantage over thorocoplasty in that it is non-deforming and non-shocking. As the compression is obtained gradually, the danger of acute circulatory and respiratory upsets is minimized, and the so-called auto-tuberculinization is reduced to a minimum because of the gradual introduction of minute quantities of tuberculin into the general circulation. Since artificial pneumothorax does not tend to lower the general resistance of the patient, there is less danger of tuberculous foci in the contralateral lung or elsewhere in the body, lighting up, as is occasionally the case following thorocoplasty. When compression can be obtained satisfactorily, the amount of compression is usually greater than can be obtained by any other means. After the disease has apparently become arrested, it is usually possible to release the pneumothorax and allow the compressed lung to resume either completely or partially, its functions. This is of particular advantage in case tuberculosis develops in the contralateral lung, or the patient should contract pneumonia or severe bronchitis. Within the past three or four years, several of the leading tuberculosis clinics have advocated the use of phrenicotomy in conjunction with artificial pneumothorax. The rise and immobility of the diaphragm has been found, at least partially, to compensate for the lessened size of the lung following the contraction of its contained fibrous tissue. It has also been found that when this procedure is

FIG. 1



Retraction of left chest with immobilization in fibrous tuberculosis left lung

FIG 2A



C.P.
8.6.55

FIG 2B



C.P.
11.18.55

Complete thoracoplasty done in two stages (a) Before operation, large cavity involving upper half of left lung (b) After operation showing complete collapse of left lung and obliteration of cavity

FIG 3A



FIG 3B

Cases of thoracoplasty after recovery (a) Anterior view of patients (b) Posterior view of patients

FIG 4B



Case of tuberculous pyo-pneumothorax treated by extrapleural paravertebral thoracoplasty and anterior unroofing (a) Anterior view (b) Posterior view

FIG 5A

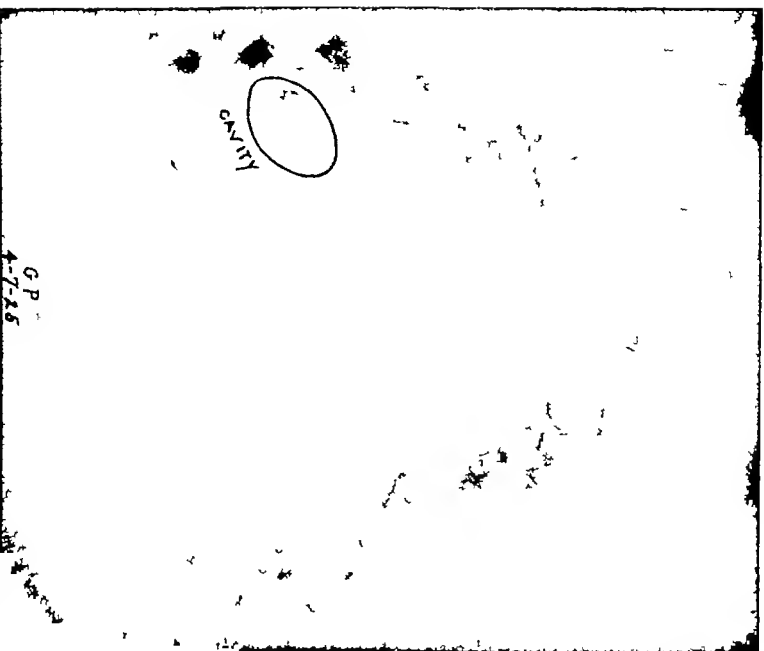


FIG 5B



Results of phrenico exeresis (a) Before operation showing large cavity in base of right lung (b) After operation showing elevation of diaphragm and obliteration of cavity



GST
9.23.4



GST
12.26

Apicectomy and upper stage thoracoplasty, right with obliteration of large cavity (a). Before operation showing large cavities in upper lobes both lungs (b) After operation showing disappearance of cavities in both lungs and complete healing

FIG 7

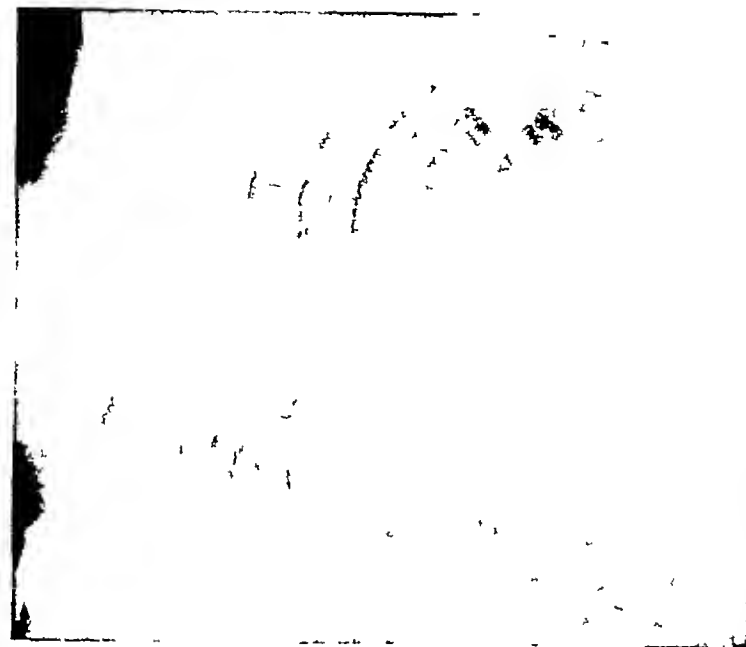


Case of pulmonary tuberculosis after apicolysis. Large cavity in upper part of right lung was compressed with complete recovery.

FIG 8A



FIG 8B



Jacobeus operation (a), Before operation showing adhesion which prevented collapse of cavity (b) After cauterization of adhesion showing complete pneumothorax stump of adhesion showing cavity collapsed

carried out, fewer effusions occur and that air re-fills need be given less frequently. This combination of phrenicotomy and artificial pneumothorax has increased the indications for pneumothorax in a group of border line cases in which thorocoplasty would have otherwise been indicated, thereby saving the patients the dangers of a more formidable procedure.

DISADVANTAGES OF ARTIFICIAL PNEUMOTHORAX

Pneumothorax has certain disadvantages in that it entails the grave risk of air embolism, which is usually fatal. If the pneumothorax is abandoned prematurely, either because of poor judgment on the part of the physician, or the unwillingness of the patient to continue the treatment over a long period of time, dense pleural adhesions are likely to form which will interfere with subsequent compression. This is especially liable to happen if pleural effusion has been present, or if the compression has been maintained for a long period of time. The closest observation must be maintained for signs of activity during the time that the compressed lung is re-expanding, and if these appear, recompression by artificial pneumothorax, phrenicotomy, or paravertebral thorocoplasty should be instituted at once. The danger of pleural effusions becoming secondarily infected is always a serious complication, and when this occurs it exposes the patient to the danger of pleural cavity drainage. If the intrapleural pressure is not carefully regulated, there is a danger of small adhesions pulling loose from the visceral surface, causing a rupture of the lung with resultant broncho-pleural fistula, mixed infection empyema, increased intrapleural pressure with mediastinal displacement, and occasionally, mediastinal flutter, all of which are serious if not fatal complications.

ADVANTAGES OF THOROCOPLASTY

It is hardly fair to compare the advantages of thorocoplasty with those of artificial pneumothorax, since thorocoplasty should be used only after attempts at the induction of artificial pneumothorax have failed, or the amount of compression obtained by artificial pneumothorax, because of pleural adhesions, has been unsatisfactory.

From an economic standpoint, thorocoplasty is often a procedure of choice over long continued pneumothorax with its attendant

dangers, as permanent compression of the diseased lung, obtained in a comparatively short time, may place the patient in a position to earn his own living sooner than with artificial pneumothorax, which necessarily would have to be continued over a long period of time

PRE-OPERATIVE TREATMENT

After it has become apparent that the patient will not make a satisfactory recovery under sanatorium treatment alone, and it has been decided that compression therapy must be instituted, a careful study must be made of the patient to determine if his general condition, as well as the tuberculosis in the opposite lung, will stand this means of therapy. It must be remembered that these patients have been the victims of a long continued toxæmia which has caused damage to the cardiac muscle, to the kidneys and liver, and possibly enteritis, either toxic or tuberculous, which must always be given consideration. Kidney function tests and blood chemistry examination are obtained to determine the extent of renal impairment. Electrocardiograms are necessary to determine cardiac damage. It is usually a wise procedure to start a patient on a course of digitalis therapy before the contemplated operation, in order that the heart may be working at its greatest efficiency. Any aggravation of symptoms or untoward signs should delay operation until the previous general condition has been restored. During the period of observation, daily sputum amounts should be noted for comparison with post-operative amounts. Morphine is never given preparatory to, or after, operation, as it abolishes the cough reflex, without which the patient is unable to empty his lung. Codeine sulphate may be substituted if necessary.

ANÆSTHESIA

Anæsthesia plays an important part in the success of thoracoplastic procedures. Local anæsthesia, while advocated by many and used exclusively by a few operators, has not proven entirely satisfactory in our hands. Ether, of course, is absolutely contraindicated because of the irritating effect upon the lungs, and the danger of lighting up quiescent tuberculous lesions.

Chloroform is contraindicated because all of these patients have more or less cardiac muscle damage.

At the Fitzsimons General Hospital, nitrous-oxide-oxygen anaesthesia combined with regional field block is the method of choice. The intercostal nerves are blocked along the line of the angle of the ribs before the nitrous-oxide-oxygen anaesthesia is started. Because of the diminished ventilation area within the lungs, satisfactory anaesthesia is difficult to obtain, and to maintain. The induction of a general anaesthesia to a patient suffering from pulmonary tuberculosis undergoing a thorocoplasty, should be undertaken only by a highly skilled and experienced anaesthetist. Frequent blood pressure readings are necessary during the course of the operation, as it has been noted that the simple cutting of a rib occasionally will drop the blood pressure from eight to fifteen points.

THOROCOPLASTY

At the present time there are two methods of extrapleural paravertebral thorocoplasty being advocated, both of which have a definite place in the compression of pulmonary tuberculosis. Brauer advocates a wide resection of from 3 to 16 centimetres, using the scapula to cover the defect in the chest wall. Sauerbach recommends a moderately wide resection, or from 2 to 12 centimetres. The Brauer method of operation is indicated where there are very extensive lesions and large cavities, the patient being in good condition, with good heart muscle, the greatest resection being over the more extensive lesions. When pneumonic or exudative lesions are present, maximum compression is indicated and artificial pneumothorax is preferable to thorocoplasty because of the general condition of these patients. If it is impossible to obtain artificial pneumothorax because of extensive pleural adhesions, a thorocoplasty of the Brauer type in two, three or four stages is preferable to the Sauerbruch method with its limited rib resection. The Sauerbruch method is preferable in those cases where there is considerable fibrosis with an immobile chest wall, diaphragm, and mediastinum which prevent the newly formed fibrous tissue from shrinking.

The operation of thorocoplasty may be done in one or two stages, both of which have their advantages.

Advantages of the One-Stage Operation

- 1 Most patients prefer only one operation in preference to

several, as they do not realize the dangers of a single-stage thorocoplasty, and how these dangers may be lessened by several operations

2 The operative risks are taken only once

3 Postponement of the operation for the second stage is not necessary in case the wound becomes infected

4 The scapula fits the defect in a chest wall better than after the two-stage operation

5 The operation can be performed through a shorter incision

6 The lung compression is uniform.

7 The liability of bleeding from upper lobe cavities is lessened

Advantages of the Two-Stage Operation

1 There is considerably less shock than is usually seen following the single-stage operation

2 There is a markedly less sudden change of respiratory and cardiac function

3 Fewer toxic products are thrown into the general circulation

4 Definite clinical improvement usually follows the first stage so that the second stage is more easily borne by the patient

The interval between operations is usually about two or three weeks, as it has been noted that in from six to eight weeks there is sufficient bony bridging over the area where ribs have been removed to interfere with satisfactory pulmonary compression

Alexander has advocated the use of phrenicotomy followed by upper stage thorocoplasty in preference to a complete thorocoplasty. He claims, that the relaxation of the lower portion of the lung, caused by the rise of the diaphragm, compensates for the compression obtained by a lower stage thorocoplasty and at the same time has not the attendant dangers. This method has recently been used at the Fitzsimons General Hospital with excellent results, and it is thought that this method holds some advantages over the method of complete thorocoplasty.

PHRENIC NERVE OPERATIONS

The operations on the phrenic nerve may be a simple division of the nerve (phrenicotomy), or removal of a section of the nerve (phrenectomy), or removal of most of the nerve with its distribution to the diaphragm (phrenic exaeresis).

After a simple division of the nerve, it has been noted that the diaphragm has resumed its function in from four months to five years. Where a section of the nerve only, is removed, the result may not be entirely satisfactory because of an accessory branch which commonly arises from the second cervical nerve. To be sure that the diaphragm will rise to its fullest extent and will not resume its function, either partially or completely, phrenic exaeresis is advised. The rise of the diaphragm following the radical operation, is usually from 4 to 7 centimetres, whereas following simple division of the nerve, only 2 to 3 centimetres' rise has been noted, and the cessation of movement occasionally is not complete. The rise of the paralyzed diaphragm allows lower lobe compression and relaxation, but as a rule has very little effect upon the upper lobe. The results obtained by phrenic exaeresis are in many ways similar to those obtained by a lower stage thorocoplasty. Paralysis of the diaphragm as a rule, does not cause circulatory, respiratory, or abdominal disturbances, and expectoration following phrenic nerve operations is usually easier, due to the fact that the strong abdominal muscles play an important part in the act. The amount of decrease in lung volume is from one-fourth to one-third the total amount. Dyspnoea rarely occurs in spite of the reduction of lung volume, and when it does occur, it is slight and transitory.

Sauerbruch advocates the use of phrenic nerve operations preliminary to thorocoplasty, in order to determine the effect of compression therapy upon the disease in the contralateral lung. While phrenic nerve operations are particularly indicated in lower lobe pathology, occasionally, startling results are seen in upper lobe pathology following this relatively simple procedure.

PNEUMOLYSIS

Extrapleural pneumolysis is used to compress cavities near the surface of the lung. When used for compressing cavities at, or near, the apex of the lung, it is called apicolysis. Compression is maintained by packing gauze, rubber tissue or bags, muscle, fat, or paraffin, between the rigid chest wall and the separated parietal pleura. Since it is impossible to maintain the desired degree of compression over a long period of time, it is thought ad. - ' to act por-

tions of the ribs over the diseased area in order to obtain permanent compression

Intrapleural pneumolysis by the open method is mentioned, only to be condemned. This procedure has many disadvantages, and no advantages over the method of intrapleural pneumolysis by the closed method, as advocated by Jacobæus.

Intrapleural pneumolysis by the closed method is indicated in cases where satisfactory compression by artificial pneumothorax was not obtained because of one or more small or moderate sized adhesions, which have not stretched sufficiently to allow the desired degree of compression. It is particularly useful where there are string or shelf-shaped adhesions, but should be used with the greatest caution on surface adhesions.

The immediate dangers of the operation, are the wounding of the lung and hæmorrhage. The former can be avoided by being careful, and the latter, by using a low heat cautery to coagulate the tissues before cutting through them. As over 50 per cent of the cases develop pleural effusion following the operation, infection of this exudate results in a serious remote complication. At best, the operation is difficult, and should only be undertaken by one who is familiar with the interpretation of reflected images.

Where the operation is applicable and is successful, it saves the patient the dangers and discomfort of an extrapleural paravertebral thorocoplasty.

SUMMARY

In the presentation of these cases, only those which serve best to demonstrate the means of compression therapy have been shown, and in discussing the various methods, no attempt has been made to go into detail, but rather to give a general idea of the methods in common use and the classes of cases in which they are applicable.

In closing, I should like to impress upon you, that when it is possible for patients suffering from pulmonary tuberculosis to make a satisfactory cure without artificial means, it is far better for the patient, and the chances for permanent recovery are far better, but, when it becomes apparent that the desired cure can be obtained only after compression therapy has been undertaken, no time should be lost in undertaking this valuable means of treatment.

Medical Questionnaires

Collated by B BICKEL, M D
Washington, D C

What are the features of influenza attracting the most attention at the present time?

Bacterial investigation still holds the attention, because too many diverging opinions have been expressed regarding the pathologic agent producing this infection. Epidemics are being reported, taking especial interest in the various features which seem to distinguish one outbreak from another in various countries and at different times. Plate reports an epidemic occurrence of involvement of the submaxillary glands, associated with influenza. It is quite a common experience that one disease modifies the other. With infectious diseases a first specific allergy develops upon first contact and the reaction to irritation from other antigens, called parallergy by Moro, is produced. Generally these diseases are surprisingly benign. It seems that the second infection actually supervenes after the first has been established. At the Hildesheim infants' home high temperatures developed in the victims during the influenza epidemic followed by a lull with normal or subfebrile temperatures for two or three days, and a reappearance of fever with swelling of the submaxillary glands, which began to diminish after two days, and after about two weeks had subsided completely. Such complications later were avoided by swabbing the throats of both the children with and those without the infection. von Barabas points out that the opinion of various clinicians differs regarding the effect of one infectious disease on the other. Measles or whooping cough seems to create a serious complication for tuberculosis, and measles complicating diphtheria is serious. On the other hand, erysipelas may improve eczema or cancer, and gonorrhoeal conjunctivitis may clear up an opaque sclera. Influenza has an unfavorable influence upon parenchymatous nephritis and bronchitis, but it does not seem to influence aortic valvular insufficiency or interstitial nephritis adversely. Improve-

ment was produced by influenza in habitual vomiting of those suffering from bronchial asthma Dorn's opinion that tuberculous patients are practically immune to influenza is contradicted by Much and others Medical literature seems to indicate that syphilitics are not especially endangered by influenza, often a positive Wassermann reaction has disappeared when influenza was contracted For hospitals some writers have supposed a curative influence from mercury vapors prevailing in syphilis wards, which would hardly apply to our modern institutions In fact, von Barabas saw many syphilitic infants succumb to influenza quickly Tuberculosis does not protect against influenza, though von Barbaras' children had mild attacks and no aggravation of tuberculosis followed The febrile conditions do not produce temporary immunity from influenza A strange fact was noted by von Barabas, namely that no other epidemics occurred in his vicinity while the influenza outbreak was in force —The newer bacteriologic investigations have made records of many microphotographs of the bacterial flora of the human body, and more especially the respiratory tract David and Robert Thomson took thousands of photographs and then concluded that the bacterial flora, more especially the streptococcal flora of the respiratory tract, contained over one hundred varieties They have adopted a new method of making cultures from human material grown on Crowe's chocolate blood agar medium. It seems to show the individuality of the various species to great advantage A stereoscopic microscope is used in studying them Photographs were taken of these cultures from the throat and sputum of the laboratory men every week all the year round When a cold or feverish attack occurs in any member of the staff cultures are photographed and compared with those taken during good health This interesting investigation has shown that the bacterial flora of the respiratory tract is chiefly streptococcal This coccus makes up 90 per cent of the total flora, and varies every week even in health Cultures of those suffering from the last epidemic in the first month of 1929 in England invariably showed large numbers of colonies of streptococcus which seemed to belong to the pneumococcus group Cultures from persons suffering from sporadic colds before the epidemic started did not show this type, but other varieties of streptococcus The germ differed considerably from that most commonly found in the epidemic two years previously Thom-

son and Thomson believe that the influenza epidemics, so-called, may be due to virulent streptococcal infections of the respiratory tract, the strains varying with the different epidemics. They do not believe that mutation occurs to any great extent in streptococcus. They remain true to type on the Crowe's medium.—Studies of the United States Public Health Service have shown that the source of the epidemics can usually be traced readily. In 1928 a group of students insisted on attending a football game at the University of California while an influenza epidemic was prevalent in California. Those having friends and visiting with them at that University were the first to contract the infection, and soon it spread to 319 cases. In this epidemic there was an absence of gastrointestinal symptoms. The cough was nonproductive at first, and the amount of sputum small. There was mottled hyperæmia of the entire pharynx, especially of the posterior wall, which was usually intensely red. In the two epidemics studied by Veldee, one in Boston and the other on the West Coast, including the cities in both vicinities, showed a low incidence, only 9.9 per cent in Boston, while in Des Moines it was 28.6 per cent, in Baltimore 11.3 per cent, and in Seattle 17.9 per cent. The incidence of pneumonia averaged 4.74 per thousand in all localities. Rest in bed and isolation should be the rule in all cases and coming in contact with others while infectious, be made a misdemeanor. It is difficult to make notification compulsory on account of the sudden onset.—Lonnqvist traces influenza back to Hippocrates. In his own country, Finland, the disease was described as a new disease, in 1742. Evidently it had spread over the entire world with large epidemic outbursts, between 1781 and 1782. The morbidity rate was unheard of for there were cities where every inhabitant was suffering from the infection. The Russian epidemic in 1788 spread over all of Europe but seems to have omitted Finland on account of war between the two countries. A few years later, about the close of the century, another influenza started from Russia and spread over Europe and continued with slight intermissions until 1803. The large epidemic in 1830 to 1833 started in Asia, reaching Finland in 1833, then there were two small epidemics in this country in 1837 and 1847, spreading over all of Scandinavia. The largest influenza epidemic known to the history of medicine was that of 1889 to 1890. The next following severe influenza epidemic was seen in

1918, and lasted for ten months, with slight intermissions. Mortality was very great in Finland at that time, possibly on account of the difficulty to provide food for the population. Other smaller epidemics were seen in 1921, 1922, and 1927. Last year, and reaching into January and February, 1929, it would seem that the disease spread from San Francisco. Lonnqvist's is one of the most extensive epidemiologic studies in a short article but clearly shows the mode of spreading of epidemics and more so of influenza, which again and again has been considered a new disease after it had failed to appear for a generation or two. The 1918 epidemic, well known to almost all countries, and transmitted rapidly under the war conditions, has caused many studies which have been more specialized than in previous epidemics. Yet all the especial studies with individual features for various countries and in the different epidemics has not been able to explain the pathology of this form of disease.

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What are the pathologic agents of otitis media?

Suppuration in the ear has for a long time been known to be caused by various bacteria and to be dependent on a complex of ætiologic factors. The germ most often found is the streptococcus, next in frequency the diplococcus lanceolatus, and various pyogenic staphylococci, not nearly as often *B. tenue*, tetragonus, diphtheriæ, pseudodiphtheriæ and pyocyanus, enterococcus, and others. Generally the search for microorganisms in the auricular purulent secretion has been made for aerobic types only. Veillon and Zuber in an operated case of chronic mastoiditis, with thrombophlebitis of the transverse sinus, and cerebral abscess found strictly anaërobic bacilli, *B. serpens* and *B. ramosus* which were grown from the

pus of the sinus, the cerebral abscess, and the blood. From some of the material a few *B. coli* and streptococci were isolated. Rist made an extensive study of the otitis flora and found mainly aerobic types in acute, and anaerobic types in the chronic forms of otitis media. He admitted that the pathologic agent in acute forms of the disease with mastoiditis is streptococcus and diplococcus as in acute otitis, but in mastoid complications with chronic fetid purulent discharge pyogenic microorganisms are mostly of strictly anaerobic type. He did not believe that saprophytes produced the fetid odor but *B. serpens* and *ramosus*. Others have pointed out the importance of anaerobic germs in chronic purulent otitis media.—Torrini and Morandini made a study of fifty-one cases of otitis media and found among twenty-two cases restricted to the mastoid eleven with diplococcus lanceolatus, only, four with streptococcus pyogenes only, two with staphylococcus, one albus, the other aureus, only, two where *B. coli* and streptococcus pyogenes were associated, one with *B. coli* and diplococcus lanceolatus, one with *B. coli* and streptococcus pyogenes and staphylococcus aureus, one with staphylococcus aureus and diplococcus. In nine cases where phlebitis was associated with mastoid lesions four showed diplococcus lanceolatus only, two streptococcus pyogenes only, the others mixed flora as above. Diplococcus lanceolatus, then, was seen in 43.90 per cent. of the acute, and in none of the chronic cases. There seems no definite relation between the type of the microorganism present and the clinical symptoms.—Marcel Lermoyez speaks of otitis media as contagious like the eruptive fevers, a contact infection which can be avoided. He thinks it is due to the rareness of this mode of transmission that so few are recognized in this sense. Both for pneumonia and otitis, colds have obscured the recognition of contagiousness. Lermoyez does not believe that all cases are produced in this manner, but a number of them. Upon closer attention two members of a family or attendants in families will be observed suffering from otitis media in close succession. Often the condition starts with influenza, or measles, or scarlet fever, and then the otitis is secondary, in the opinion of Lermoyez. Hospital patients are more likely to contract it than the private patients who show this complication in contagious diseases in one to two per cent. against twenty to twenty-five per cent. in the hospitals.

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What has been gained in cerebral topography?

The path of science from crude physiognomistic studies to present-day recognition of cerebral functional areas has led over tortuous road Soothsayers, educators, the clergy and artists introduced philosophy, morals and mysticism into the problem, and it is only after anthropologists, anatomists, embryologists, surgeons and last, and of most importance, the psychiatrists took the study firmly in hand that the onus of pseudoscience was lifted—Among the first physiognomists were such men as Zopyr, Hippocrates, Jean of Hagen, Perucchio, Rabelais, Leonardo da Vinci, Abbé Thiers, and many others BÉlot believed the forehead governed by Mars, the right eye by the sun, the left eye by Venus, the right ear by Jupiter, the mouth by Mercury, and so forth Lavater found great pleasure in likening the traits and shape of the skull of great men of his time to animals Gall, the man of great renown in connection with physiognomic and cranial studies, divided the brain into areas which he thought governed by the various functions of the mind Yet he was so far unbiased to state that the physical make-up does not govern the moral behavior which was rather liberal for his time Nemesius, long before Gall, had located sensations in the anterior ventricles, intelligence in the central portions, and memory in the back of the head Gall distinguished twenty seven cerebral organs, nineteen of which he found both in man and animal, and eight present in man only, he found an organ of religion, and so forth Spurzheim changed the nomenclature somewhat At the beginning of the nineteenth century lectures were held at various scientific centers on topography of the supposed functional brain centres Blainville and Vimont of the Edinburgh school lectured on comparative craniology Sculptors soon adopted the habit of making measurements of the skull Broca in 1859, after several months of discussion at the Anthropologic Society of Paris, endorsed Gall's theories At the close of the nineteenth century Pierre-Marie showed that Broca's centre did not exist, and that neither speech nor writing originate in a preformed centre

For more than thirty years most men of the medical profession were reluctant to attempt an understanding of the functioning of the brain, and much painstaking work has failed to become common property of the profession. Two years ago Dr. Constantin von Economo, whose book was translated into French by van Bogaert, has issued an introduction to his atlas of the brain. It gives the details of cell structure of the cerebral cortex, of which he describes 109 types. He groups them into five main forms. It increases the cortical areas of Brodmann to more than double. Flourens had believed that the cerebral hemispheres participated in their entirety in every brain function. The names of Munk, Goltz, and Loeb are associated with the fruitful work done in cerebral topography fifty years ago. Since then careful anatomical work has disclosed many facts. The various layers and structural areas of the cerebral cortex have been investigated by many, among them the great specialist Brodmann. Cécile and Oskar Vogt have been named with von Economo during recent years. The hope that one would ultimately succeed in dividing up the entire cortex into neatly functioning isolated areas which were set aside each for a definite activity, has not been fulfilled. C and O Vogt distinguished 200 cortical sections in each hemisphere, Brodmann distinguishes fifty-two, and von Economo fifty-four basic areas and 107 territories. Vogt believes that they are divided off by a hair's breadth while von Economo believes that only a few are so distinct. For example, Vogt calls the totals of Purkinje cells in the cerebellum, a topical unit, likewise the gray substance in the pallidum and substantia nigra and dentatum which is rich in iron, the crests of the convolutions on one hand and the portions dipping down separately.—So far it is agreed that certain definitely localized pathologic processes or malformation of the brain can be recognized by certain symptoms. Clinical cerebral pathology in the main rests on the pathology of the sensory centres of Flechsig. C and O Vogt believe that one can determine whether a paralytic has had a chorea or not by examining the brain. They, furthermore, discovered that the changes found by Mcyner in the Ammon horn in epilepsy are situated at the same point in paralytics, and were located by Ranke in a case of dementia præcox, also in amaurotic idiocy, Huntington's chorea, spasmophilia and senile dementia. C and O Vogt further found to their surprise that the brain of an intellectual individual di

a much smaller area striata than a hospital patient's Professor P Schroder points out that the different areas are not yet sufficiently divided off to know how large each should be normally or in certain individual brains

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SCHRODER, P "C and O Vogt's Cerebral Topistic in Psychiatry," *Klin Wchnschr*, vol 8, p 1759, 1929

What are the clinical aspects of venous pressure?

J A. E Eyster in his book just from the Macmillan press gives a physico-mechanical description of the pressure conditions in the circulatory function, and more especially of that of the venous system He states that the venous pressure in part constitutes a pressure residue after the resistance in the peripheral vessels has been overcome A progressive fall of blood pressure through the arterioles, capillaries, venules, and veins is the result of the physical conditions in the systemic circulation The blood normally returns to the heart with a definite though a small residual pressure The heart, as the terminal portion of the circulatory system, is a closed organ in which there is always a positive pressure The venous pressure at the heart determines the positive pressure to which auricle and ventricle are exposed in diastole By its contraction and amount of blood expelled are governed under normal conditions The pressure in the larger peripheral veins is ordinarily between forty and sixty millimetres of water, and rarely more than 110 millimetres The cardiac venous pressure is about the same Cardiac decompensation or cardiac failure exists where the venous load exceeds the capacity of the heart to respond with increased activity in moving the blood effectively from the venous portion into the arteries This occurs where the heart muscle has been damaged by disease, from degenerative processes supervening on muscle hypertrophy, or from toxæmia, pneumonia, acute infectious diseases Of recent years compensatory hypertrophy of organic cardiac disease is considered a response to an injury in the muscle fibres which produces stretching The mechanical capacity is increased for a time

to lead to degeneration and a lessened capacity in carrying the cardiac load. The heart does not send the venous blood on adequately, and further accumulation in the venous system is the consequence. The venous pressure rises. Most of the clinical symptoms are directly attributable to the high venous pressure which accompanies cardiac incompetence. The lungs, liver, spleen, and other organs become congested. Less urine is secreted and more water retained. Changes in venous pressure precede the symptoms, so that frequent pressure taking may afford a warning. In lobar pneumonia this procedure is especially important.—In the recumbent position, and when the body is at rest peripheral venous pressure is within normal limits as long as the heart is competent, in spite of clinical conditions which would lead one to expect otherwise.—Posture has a marked influence upon the venous pressure. Older subjects usually show a higher venous pressure when in a sitting position than younger individuals, but in the recumbent position there is hardly any difference. Unusual muscular activity leads to increased heart filling under a higher initial pressure and a subsequent increased cardiac output. Lifting of weights, straining at stool, and other exertions, put an additional venous load upon the heart, especially if the organ has suffered from long existing toxæmia. Similar conditions are seen in heart failure occurring in lobar pneumonia and diphtheria, and are sometimes seen in other acute infections. The venous system of older subjects with frequent attacks of infectious diseases or influenza or syphilis is especially vulnerable. Eyster recommends venesection and rest in mild cardiac failure to protect the heart from overload.

EYSTER, J. A. E. "The Clinical Aspects of Venous Pressure," New York, The Macmillan Company, 1929.

Can rhinopharyngitis be controlled?

If R. G. Turner isolates bacteria from the nasal cavities and middle ear of test animals deprived of vitamin A his statement signifies that there are many factors entering into the damage done to the upper respiratory tracts. Worms, in fact, calls the onrush of damaging agents which meet a man coming in from the country a respiratory shock. It is well known that young people who are used to living in the country on entering the city encounter dust smells, solid and gaseous substances, all laden with germs, soon develop an irritation.

of the nasal passages, the tonsils and the throat, which may extend to the bronchi and lungs, or to the ears. Associated with this attack from without is the change in diet which does not contain the same plain and helpful foodstuffs. Turner proved that fatal septicæmia may be produced in rabbits by organisms isolated from the suppurations of the upper respiratory tract and middle ear of test animals suffering from the lack of vitamin A. The organisms producing this effect appear as Gram-negative cocci and have fermentative powers. Endotoxins and probably not toxic substances secreted by the organism constitute the active principle. There has been a gradual increase in frequency of infections of the upper respiratory tract during the last decade. The pituitary glands and its appendages are not capable of resisting the damaging effect of germ-charged air. Into the equation enters the overheating of rooms which has resulted from general adoption of central heating. Not only the upper tract is involved, but also the eyes, the gastrointestinal tract, and the nervous system. People with involvement of the rhinopharynx by germ damage are apt to lose their acuteness of memory, they have headaches, are unable to work, or may become neurasthenic. Among them are numerous victims in every influenza epidemic. Many people have the habit of disinfecting their noses, especially when a cold is contracted, or while an epidemic of colds or influenza is threatening. The disinfectants used are generally of uncontrolled strength, and do not always serve the purpose, furthermore, they do not reach more than the nasal cavity. Worms believes that the posterior pharyngitis is the primary lesion. He recommends nasal and retronasal spraying introducing the long nozzle which is bent, and turned upward so that it curves around the back of the nasal structure. In this manner it reaches the sinuses and upon blowing the nose vigorously it is surprising how much material is expelled from the entire upper portion of the respiratory tract. Applying this spray to children the head should be bent forward so that the mucus can run out of the nose. Many carriers of various infections are not detected, for a chronic diphtheria carrier may remain unobserved because the mucus containing the germs is expelled by the common methods of evacuating the nose. Nasal douches are by no means insufficient and carry danger for the ears if applied in the wrong manner. So-called nasal baths are preferable, because no violence is produced by it, but the retronasal spray

does not cause any gagging or cough, and, therefore, people are willing to employ it. A 1 per cent collargol solution with a little phenic solution, possibly 1:50, is a good spray and dissolves the tough mucus. A 5 per cent salicylic solution or some alkaline solution does not injure the membranes or the epithelium, yet dissolves the deposits. For children physiologic saline is useful as long as they cannot cough or expectorate. A hypertonic 5 to 50 per thousand saline solution is especially indicated in chronic germ carriers. It may be applied four to five times a day and produces abundant nasal discharge. Bacteria are dislodged from the crypts of the pharynx. The spray cleanses the tonsils and the sinuses. Dakin's solution, one-tenth, is a very effective disinfectant.

TURNER, R. G. "Bacteria Isolated from Infections of the Nasal Cavities and Middle Ear of Rats Deprived of Vitamin A," *Jour infect dis*, vol 45, p 208, 1929.

WORMS, G. "The Bad Effects of Rhinopharyngitis and the Best Method of Disinfecting the Oral Cavity," *Presse méd*, vol 37, p 1229, 1929.

What is now done in the treatment of burns?

The commonly employed bismuth, oil and lime water mixture is inconvenient. It stays pain only for a short time. Tannic acid has been reported as having decreased mortality from burns with fire, hot water or acids. Dunn believes that there is no perfect treatment.

Much depends upon the degree of the burn in choosing the remedy. There is first an erythema, then a blistering, partial destruction of the skin, not to speak of the more extended injury of destruction of subcutaneous tissues, bones and muscles. There are generalized symptoms, such as lowering of consciousness, pallor, subnormal temperatures, cold moist skin, low blood pressure, and small rapid pulse, all more or less due to the shock. In such cases the patient needs rest after pain has been relieved. Burns heal by epithelization. The local applications aim at diminishing toxin absorption, which most remedies claim. Tannic acid, furthermore, produces a dry, insensitive and aseptic wound.

Clock claims the same avoidance of absorption of toxins from the use of normal horse serum, the application of which is preceded by a bath of warm physiologic solution of sodium chloride. Further, Clock finds that no scar remains, even after extensive burns, that no

grafting is necessary nor deformity produced, that hair-bearing skin is restored with this especial feature. The epidermal tissue forms rapidly all over the burnt area. The horse serum may be used as a spray with cresol. The exuding tissue plasma, he claims, provides physiologic food.

Wagner uses alcohol. The burnt parts are immersed in ethyl alcohol. Pain disappears immediately, no blister forms. The drug disinfects the lesion. In an emergency he has used drinks containing thirty to forty per cent alcohol. Denatured alcohol is always harmful, but in order to avoid abuse 1 1000 iodoform may be added. Wagner believes that alcohol should be contained in all first-aid outfits for burns.

DUNN, EDW. P. "Rational Treatment of Burns," *Jour of Surg*, vol 6 n ser, p 519, 1929

MONTEITH, STEPHEN R., and CLOCK, RALPH O. "The Treatment of Burns with Normal Horse Serum," *Jour Am Med Assoc* Chicago, vol 92, p 1173, 1929

WAGNER, O. "Alcohol for Burns," *Chem Zeitschr*, p 689, 1920

What are the theories about yaws?

Yaws and syphilis are classed as infectious granulomata. *Treponema pertenue* cannot be differentiated from *Spirochaeta pallida*. The serologic findings are similar, and in both the luetin test is positive. Both have three stages. Yaws develops an initial granuloma (frambæsioma), then a generalized eruption, and at last a tertiary stage with involvement of arteries, bones and internal organs. In the tropics, between Cancer and Capricorn, yaws attacks the dark races only while it is exceptional in white persons living in the tropics. It used to be endemic among the slaves on the ships, according to Sydenham, and was prevalent in Africa in the fifteenth century when it was treated with mercury. At present it prevails in the Congo, the Free State, in the Kenya Colonies, and Uganda. In the Malay Peninsula, Siam, East India, the Philippines, and in the West Indies it is common. In Haiti 400,000 cases are reported annually. It does not exist in Japan, and is rare in India and China.

J. Hutchinson insists upon its syphilitic nature. Castellani in 1905 discovered a sharp-cut, corkscrew spiral, the *Treponema pertenue* as the pathologic agent. This germ has been demonstrated in the lymphatic glands and spleen, though he did not find it in the

blood But the blood is infectious for monkeys Schlossberger and Pigge infected rabbits with well developed syphilis and frambæsia chancie with the blood of mice inoculated with recurrens Only in a few instances did the animals take recurrens infections, though they normally would do so Recurrens spirochætes were found in the blood only for a short time, but in the chancres they continued for several weeks beside the frambæsia and the syphilis spirochætes No antagonism was found between recurrens and syphilis—or frambæsia spirochætes Several weeks after the primary lesion healed popliteal glandular material was inoculated into normal rabbits, and later these animals developed typical frambæsia or syphilis chancres The existing recurrens immunity, then, did not change the reaction of the rabbit system towards syphilis spirochætes Schobl, in 1928, made experiments and in monkeys produced generalized yaws He takes issue with the textbooks which state that yaws is never primary on mucous membranes If natives do not contract it while young they will take the infection in adult life It is a contact infection in the tropics, not so in temperate regions Ramsay saw it in the higher colder mountains of Assam produce lesions like condyloma, but in the lower plains it was a generalized condition and florid

The lesions during the secondary stage are circinate, lichen-like, or maculo-papular frambæsidies, or papillary on the palms and the soles It shows osteoperiostitis, and rarefaction of the bone, or periosteal nodes similar to syphilis, onychia, sabre shin, deformities of the arms and fingers, or gangosa, juxta-articular nodes, or goundou Salvarsan is a specific for yaws

In Haïti the only essential difference found by Parsons between yaws and syphilis was in the site of the primary lesions There were a great number of positive cerebrospinal fluid reactions in the syphilitic groups Cord lesions, not tabetic however, occurred among the syphilitic group studies, but not among those with yaws Syphilis is universal in Haïti Hashiguchi in his experiments with yaws found a seasonal variation The infection was more successful in fall and winter Salt water natives in British Solomon Islands showed a higher rate of infection than the bush natives A high rate of infant mortality is seen from yaws in that region

CRICHLAW, N "The Prevalent Diseases of the British Solomon Islands,"
Trans Roy Soc Trop Med. and Hyg, London, vol 23, p 179, 1929

- HASHIGUCHI, M. "Influence of Seasonal Variation of the Generalized Symptoms in Rabbit Yaws," *Lues, Bull de la Soc japonaise de Syph*, Kyoto, vol 3, p 141, 1929
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- PARSONS, R P "Spinal Fluid in Tropical Syphilis," *U S Naval Med Bull*, Washington, vol 26, p 916, 1929
- STITT, E R "The Diagnosis and Treatment of Tropical Diseases," Philadelphia, P Blakiston's Son & Co, p 149, 1929
- TODD, K. WALTER "Halarsol and Yaws Two Further Series of Cases," *Trans Roy Soc Trop Med and Hyg*, London, vol 23, p 201, 1929
- "Yaws and Syphilis," Monthly Meeting Med Department Officers at Manila, Philippine Islands, *Mil Surgeon*, Washington, vol 65, p 450, 1929

Have cultures of Spirochæta pallida been successful?

Kolmer believes that no unmistakable growths of either virulent or nonvirulent Spirochæta pallida have been obtained from human or rabbit syphilitic material. He employed seventeen kinds of media for its cultivation, and failed. Saprophytic spirochætes were found in smegma and saliva. He believes it highly probable that many alleged successful cultures of Spirochæta pallida have been growths of pallida-like saprophytic spirochætes. "The fact that spirochætes have and can be cultivated is fully established," Kolmer says, "so far as saprophytic organisms from smegma and saliva are concerned." "Nothing is definitely known of the agencies by which Spirochæta pallida produce the lesions of syphilis." Some of the symptoms of the disease suggest the production and activity of toxins in the organism, but he believes these have not been demonstrated. No filtrable or soluble exogenous toxins could be found in the cultures of the spirochætes alleged to be Spirochæta pallida but non-virulent forms in the rabbit. No exogenous toxins could be demonstrated in the filtrates of the tissues of acute testicular syphilis in the rabbit.

Schereschewsky, Muhlens, Levaditi, Uhlenhuth and Mulzer, Arnheim, and others, had negative results with mixed cultures in the lower and the anthropoid apes and in rabbits. Therefore animal pathogeneity of culture spirochætes has been subject to doubt. Bruckner, in 1910 succeeded in producing a typical syphilitic orchitis with spirochætes sixty days after inoculating a mixed culture of second passage into the right testicle of a rabbit. Generalized syphilitic infection was reported in rabbits by intracardial or intra-arterial

inoculation with mixed and pure cultures W H Hofmann succeeded in producing syphilitic orchitis in rabbits with pure cultures of pallida Noguchi reported positive results with pure cultures in rabbits and monkeys Mulzer reports positive results from reculturing of material from testicular syphiloma

The demonstration of the organisms in the cerebrospinal fluid has been reported in only a few instances In 1905 Dohi and Tanaka, and also Sézari and Paillard, Gaucher and Merle, Levaditi, Marie and Bankowski have made such reports Many investigators have failed again and again, even under most favorable circumstances Wile and Kirchner believed this failure due to faulty methods and devised a new technique, staining as advised by Warthin and Starry Warthin among 101 specimens of cerebrospinal fluid found spirochætes in twelve Six of this group had a positive blood Wassermann reaction while the cerebrospinal fluid had a negative reaction, except in one One case of tabes with optic atrophy had a positive reaction of the cerebrospinal fluid and fragmented forms of spirochætes were found In one other case with testicular gumma, a strongly positive Wassermann reaction in the blood and negative in the cerebrospinal fluid was found with spirochætes demonstrated in the latter

HOFFMANN, ERICH, HOFMANN, EDMUND, and MULZER, PAUL "Morphology and Biology of Spirochæta pallida Experimental Syphilis," *Handbuch der Haut-und Geschlechtskrankheiten*, vol 15, part 1, p 205

KAST, C, and KOLMER, JOHN A. "Concerning the Cultivation of Spirochæta Pallida," *Am Jour Syphilis, St Louis*, vol 13, p 419, 1929

KOLMER, JOHN A "Toxin Production by Spirochæta Pallida," *Arch of Dermat and Syph*, Chicago, vol 20, p 189, 1929

WILE, U J, and KIRCHNER, AUGUSTUS "A New Method for the Demonstration of Spirochæta Pallida in the Spinal Fluid," *Arch of Dermat and Syph*, Chicago, vol 8, p 831, 1923

Are Koch Bacilli sent from the head to the lungs through the lymphatics only?

The invasion of the pulmonary apex has been often discussed in so far as it proceeds from the tonsils through the cervical lymphatic glands Anatomical habitus and physical habitus of the thorax and neck have often been described as causative factors in the production of pulmonary tuberculosis Reinders has shown that in 90 per cent of cases for surgical intervention in tuberculous subjects the cervical

lymph glands require the operation. He believes that the supraclavicular fossa with its large vessels and nerves and the lymphatics forms the meeting place of the various systems of both the head and the lungs, and that infection proceeds thence. Any banal affection of the upper respiratory tract is known to have its influence upon the lungs. Often chronic apical congestion yields after a sinusitis has been cleared or after an infected tonsil of the same side has been removed. Wingfield has noted the frequent coincidence of oral sepsis and tuberculous symptoms, and how improved oral conditions alleviate the chest condition. Teeth, tonsils, and nasal cavities, if infected, are liable to cause a pulmonary involvement. Campani insists, generally of the same side. Often dental conditions, and tonsillar invasion are bilateral, otitis is a better example to prove the migration of infection from the affected ear, along the lymphatic glands of the same side to the pulmonary apex. Frequent attacks of respiratory inflammation produce pleural adhesions at the apex, pain, often taken for neuralgia and myalgia, will point to the course taken. The pain may be caused by the infected lymphatics. Our knowledge of the lymphatic system is still unsatisfactory. Campani believes that not only this physiologic route is taken by infections, but that pathologic ports of entry are liable to be sought by the Koch bacillus. He is of the opinion that close scrutiny would reveal their entry into accidental cutaneous openings, that children with small lesions will carry the infection on their hands into the oral mucous membranes. He thinks that prevention of such transmission is possible. First the oral and nasal cavities should be kept free from infectious material, and the faces and hands of the children and adults who come in contact with tuberculous subjects and material should be kept scrupulously clean.

CAMPANI, A. "The Direct Route of Tuberculosis Infections from the Region of the Head to the Pulmonary Apices," *Gazz. degli Osped. e delle Clin., Milan*, vol. 50, p. 873, 1929.

What are some of the newer blood tests for hæmaturia?

Ziegelroth submits a new simple blood test which is very exact for criticism. It is based on the catalase content of the blood. Blood is the strongest organic catalyzer, he finds. It liberates oxygen readily even where it is present in small quantities in loose oxygen combina-

tions, such as hydrogen peroxide and perborate of sodium. If one drop of blood is diluted with 1,000, or 10,000 parts of water, hydrogen peroxide or a knife point of perborate of sodium added to it will produce catalysis, and oxygen gas bubbles begin to rise. The slightest traces of blood may be disclosed in the urine in this manner. The bubbles produce a top layer of foam on the mixture in the test tube which will remain for a short time, and its density and extent will give an indication as to the amount of blood contained in the specimen of urine. No boiling is needed. The benzidine test cannot be made without previous preparations, as de Jager states. Boas, therefore, suggests filtering of the urine, then passing of the reagent through the same filter. He mixes 0.25 gram benzidine with 0.20 gram BaO_2 and dissolves it in 4 cubic centimetres of a 50 per cent acetic acid. If blood is present the filter turns blue. Instead of this reagent one may use one of van Meich's benzidine tablets.

BOAS "On Benzidine Reaction in the Urine," *Wien Klin Wchnschr*, vol 42, p 368, 1929

ZIEGELROTH, P "A Very Sensitive and Simple Blood Test, Especially in Hematuria," *Deutsche med Wchnschr*, vol 55, p 1641, 1929

Can measles be prevented?

Everybody knows how dangerous measles may become for small debilitated or tuberculous children, especially if an epidemic of measles follows upon some other epidemic as of scarlet fever or diphtheria, and for whooping cough measles is one of the most dreaded complications. In large measles wards of the hospitals the mortality averages 7 to 9 per cent. According to Ziegler, 25 per cent of all fatal cases in the scarlet-fever ward of the Franz-Josef Hospital were due to complications with measles in 1926-1927. Pfaundler considers a measles epidemic more dangerous than one of scarlet fever or diphtheria—Recently, whole blood of adult donors has been used as a protection against measles. A mother injected a child on the third day after exposure with twenty cubic centimetres of the mother's blood. The child did not develop the disease although it was in constant contact with the patient. Childless serum is not easily obtained but it seems that serum from a child who has measles long before serves the purpose. But this is

children in this manner and only one contracted measles, though some were immunized as late as seven days after incubation. There is a certain humoral immunity during convalescence. However, the antibodies disappear from the blood after a time and the adult has only a certain number of antibodies, though he is immune from measles. This is similar to the Pirquet allergy theory. There seems to be a renewed formation of measles-immune bodies in adults, who have had the infection when young, when they come in contact with patients. Degkwitz uses a prophylaxis against measles which has saved the lives of thousands of children. It is necessary that the serum be taken at a certain time of convalescence of children with measles, and that they should be negative to tuberculin. In large cities it is practically impossible to get enough of this serum. Baar believes that the normal serum of adults, even in large quantities of from twenty to thirty cubic centimetres, does not afford dependable protection, though it may weaken the impact. Degkwitz tried animal measles serum but the results were not good. The Tunichiff immune serum taken from goats was not satisfactory.—Baar's results with the seventy-three children quoted above were gained with blood of children in the prodromal stage and during the first days of rash, which is called the sterile period, it was put into a solution of tyrodel and left in the thermostat for forty-eight hours. In the meantime the Wassermann test was made, and the measles virus inspected for freedom from bacteria. Five cubic centimetres of the virus was injected under the skin of adults. At first Baar and his colleagues tried it on themselves, later professional donors were used. Seven to nine days after the fever has subsided, that is about four weeks after infection, the serum is most effective. The best time to use the blood is two to three weeks after the injection.

BAAR, HEINRICH "Prophylaxis of Measles with Reactivated Serum of Adults,"

Wien Min Wchnschr, vol 42, p 1140, 1929

BADER, GEORGE B "The Intramuscular Injection of Adult Whole Blood as Prophylactic Against Measles," *J A. M. A.*, vol 93, p 668, 1929

DEGKWITZ, R. "Essays with Measles Convalescent Serum," *Ztschr f Kinderhik*, vol 25, p 134, 1920

GERLACH, H "Prophylactic Protective Vaccination with Desfibrinated Blood of Adults in Measles," *Monatschr f Kinderhik*, vol 28, p 236, 1924

RIETSCHEL "Measles Prophylaxis," *Ztschr f Kinderhik*, vol 20, p 127, 1921

unless the patient's home is in an unfavorable or unaccustomed geographic location. Hæmorrhage is always serious, especially if it comes on in the midst of apparent good health. Repeated sputum examinations are the duty of the family physician. He must aim to calm the family in the event of hæmorrhage, ten cubic centimetres of a 10 per cent salt solution injected into the veins may stop the hæmorrhage. Other remedies are employed for this purpose which at present are concentrated calcium chlorate, afeñil, subcutaneous injections of gelatine, Clauden, Stryphnon or coagulen, 10 to 20 per cent camphorated oil, and, to calm the patient, one spoonful of ten sodium bromate, twenty sodium chlorate in 200 water. The food should be tepid, and the patient should not lie flat on his back, because it is difficult to cough in this position.

BAYLE "Aid in Treatment of Tuberculosis by Splenic Opothrapy," *Rev Tuberc*, Paris, vol 10, 3rd ser, p 335, 1920

CIOFFI, EMILIO "Aids for the Treatment of Tuberculosis," *Il Morgagni*, Naples, vol 71, p 302, 1920

NEUMANN, WILH "The Family Physician's Care of Tuberculosis," *Mitt d Volksges* amt, Vienna, No 8, p 220, 1920

SAUERBRUCH, F "Statement Regarding Dietary Therapy of Tuberculosis," *München med Wchnschr*, Munich, vol 76, p 1303, 1920

What are the further developments in the investigation of undulant fever?

In recent years the increase in the number of cases of *Brucella melitensis* infection in the United States seems to indicate a more common recognition of this disease, though some have believed that it was a new malady just developed. An epidemic of this disease occurred in Iowa in 1928, the infections were abortive forms of *Brucella melitensis* and were seen mostly in farmers. Over 125 cases were studied carefully, the common symptoms, as reported before, were found and frequently the spleen was enlarged. The fever was intermittent or remittent, but not actually undulating. The diagnosis was made with the agglutination test, and often blood cultures could verify the decision.—In Illinois twenty-eight cases were reported to the United States Public Health Service, and eight cases were seen at Belmont Hospital. Francis, in Tice's "System of Medicine," referred to 679 cases in 1928. There were twenty-four deaths in the group. Some of the patients admitted

exposure to venereal diseases, which query was suggested by positive Kahn and Wassermann reactions. One of the patients had an enlarged aortic arch.—The Government Serum Institute at Copenhagen examined the serum of 500 patients suffering from undulant fever, within twenty months. All agglutinated at least at 100 dilution. In almost all instances the investigation disclosed that this reaction indicated an infection by the above microbe and was caused by cattle with infectious abortions. The reactions continued for a few months or a year, or more. Bacterial strains were isolated from twenty-three patients. They could not be differentiated from the bovine type of *Bacillus abortus* Bang. They did not resemble the caprine and porcine types in the same degree. The age, sex, and occupation of the patients pointed to cattle infection. In most instances it was not the ingestion of milk or milk products, but other contacts which had brought on the infection. Pregnant women infected with this germ have a great tendency to abortion. In one case the bacillus could be cultivated from the placenta.—In Virginia a case was seen with periodic swelling of the knee-joints, diagnosed as an intermittent hydrarthrosis. This condition was associated with many features of undulant fever.

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- BRUNTSCHWIG, A., AND JANOWSKI, J. M. "A Report of Two Cases of Tularemia in Chicago," *Illinois Med. Jour.*, vol. 56, p. 195, 1929.
- HARDY, A. V. "Undulant Fever," *J. A. M. A.*, vol. 92, p. 853, 1929.
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- KRISTENSEN, MARTIN, AND HOHN, P. "Bacteriologic and Statistical Investigations on Febris undulans in Denmark," *Zentralbl. f. Bakt. Parasit.*, etc., O., vol. 112, p. 281, 1929.

Does planting of lactic-acid bacilli in the intestine suffice to overcome harmful fermentation?

Schieblich experimented on rats and showed that mere feeding of lactic-acid bacterial cultures for the purpose of converting the intestinal flora into a lactic-acid bacterial flora was futile if a sufficient quantity of milk sugar was not given simultaneously. Marked surplus of bases in the diet and high albumin control

change of the flora to lactic-acid bacterial flora difficult Rats were fed mixed diet with preponderance of vegetable or animal food and the intestinal flora was equal to that of the herbivorous domestic animals In three cases all parts of the intestine contained lactic-acid bacteria, and often they were numerous In most of the animals, long lactic-acid rods were more numerous than lactic-acid streptococci *Bacterium coli* was always present There were also short rods, coryne bacterial strains, spore-forming strains, micrococcus, yeast anaerobic germs were not found in large quantities, and were absent in some parts of the intestine An anaerobic fermentation proper, then, hardly occurs from feeding mixed diet with vegetables predominating

SCHIEBLICH, MARTIN "The Metschnikoff Theory and the Influence of Diet upon the Intestinal Flora, Growth, Propagation, Behavior and Blood Picture of White Rats," First Communication, *Zentralbl f Bakt, Parasit*, etc, vol 112, p 188, 1929

SCHIEBLICH, MARTIN "The Metschnikoff Theory and the Influence of Diet upon the Intestinal Flora, Growth, Propagation, Behavior and Blood Picture of White Rats," Second Communication, p 206

Has the problem of preventing birth pain been solved?

Morphine-scopolamine anaesthesia holds danger for the child, though it is extensively employed in the lying-in hospitals It prolongs the time of labor, paralyzes the infantile respiratory centres, for the morphine and scopolamine reaches the foetal circulation through the placenta Post-partal oligo or apnoea or asphyxia is apt to occur, but generally resuscitation is possible, and deaths are rare wherever the cardiac and respiratory functions have been carefully watched It is difficult to distinguish death from the alkaloid and foetal death This type of anaesthetic makes more operations necessary than are commonly expected after delivery without deadening of pain by drugs —Morphine-scopolamine anaesthesia cannot be made in the home of the patient, unless both physician and midwife are well trained and available —Somnifen, which has been used by a number of clinics, contains isopropylallylbarbital acid and diethylbarbital acid, the latter is identical with veronal It has been discarded by many Pernokton, a derivative of barbituric acid, has been given in doses of one cubic centimetre of solution per 12.5 kilogram body weight, injecting slowly Ether or avertin has been tried for

rectal anæsthesia Gwathmey's method employs morphine, magnesium sulfate and æther, two cubic centimetres of a sterile solution. One hour after the first injection a solution of 0.6 Chinin hydrobrom, alcohol 80, æther sulfur pro narcosi 700, olive oil ad 1200 is given per rectum. The resulting sleep lasts about four hours, but pain decreases markedly in many cases. One of the difficulties is to keep the solution from running out of the rectum. Avertin has been referred to with much enthusiasm. Its preparation requires much skill, for if it is not well prepared severe rectal damage may be caused. Hussy has used tachin tablets by mouth, containing 0.00921 gram æthylmorphine (Dionin) and 0.00579 gram diethylbarbituric acid—From sixty to eighty drops of chlorethyl aspired for a few minutes generally eliminates pain entirely, solæsthine may be used during the worst minutes intermittently. Then there is epidural or sacral anæsthesia with sodium bicarbonic puriss, sodium chlorate, novocain, sodium sulfuro and water. Hornung does not consider the problem solved.

HORNUNG, R. "Preventing Pain During Confinement," *Berlin Klin*, vol 30, p 402, 1929

What is the nature of exanthematides?

They are eruptions provoked by microorganisms or their toxins, which reach the skin by way of the blood stream, according to Barber, similar to syphilides, tuberculides, and leprides. Many of the specific fevers are associated with cutaneous manifestations, and the best studied are the tubercle and the Treponema infections. Some skin diseases occur more frequently in mental defectives than in others. Acne, warts, herpes auricularis and genitalis are seen in mental defectives, warts are entirely or mostly due to auto-intoxication from the intestinal tract. Rheumatic diseases, especially the febrile type, have cutaneous symptoms. Streptococcus has been conceded to be the causative agent, though, as Barber points out, it is probably a condition of allergy to certain streptococcal groups. In both tuberculosis and rheumatic fever lesions occur in the walls of serous cavities or joints associated with serofibrinous exudate. In both rheumatic fever and syphilis, Swift, Derick, and Hitchcock point out, there is a marked tendency to focal endo- and perivascular involvement, and they often attack the heart—Among the exan-

thematides are then classed cutaneous symptoms of tuberculosis, syphilis, rheumatic streptococcal infection, and severe ringworm, the latter producing a generalized eruption resulting from a local infection of the skin with ringworm fungi. Darier calls the later trichophytides. In man a severe ringworm invasion may produce an allergic state, with reaction to trichophytin and positive cutaneous tests, persisting for years after the infection has been cured. Reinoculation produces a transient slight lesion. Animal experiment has shown that cutaneous inoculation only is effective while subcutaneous inoculation fails. Ulcerating ringworm may be associated with generalized eruption, enlargement of lymph glands and spleen, swelling of joints, and polymorphonuclear leucocytosis. The fungus spores may be carried through the blood stream. In some cases the infection spreads by way of the lymphatics from the port of entry. — Impaired function of the skin is a predisposing factor in the development of rheumatic conditions, furthermore the skin's relation to the endocrine glands and the nervous system enters into the resistance of the body covering to certain bacterial invasions. This is demonstrated by the beneficial effect which stimulation of the skin, either by increasing sweat secretion, or by flushing the cutaneous blood vessels, or by producing erythema inflammation, has upon rheumatic conditions. Skin eruptions are generally considered as protectors against the more deadly forms of syphilis and tuberculosis, and in rheumatism.

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Should surgical treatment be recommended in appendicitis during pregnancy?

There may be true peritoneal reaction, the origin of which is erroneously attributed to the appendix. Salpingitis, twisted ovarian cyst, ruptured ectopic pregnancy, cholecystitis, perforated gastroduodenal ulcer, or tubercular peritonitis with sudden onset may simulate an acute appendiceal crisis. Both internists and surgeons may err. The physician's mistake does not seem so serious as he passes the patient on to the surgeon. But there are a number of conditions which call for medical treatment only, for instance

hepatic or renal colic, intestinal inflammation, lead colic, tabetic crises, typhoid, pulmonary congestion of the right base, all of which may resemble appendicitis in the beginning. If, however, the diagnosis at the onset of appendicitis is missed the reasons for such errors are either the absence of some of the cardinal symptoms, or the local symptoms in the right iliac fossa may be insignificant—such as a little general discomfort, fever, tachycardia, vomiting—or diffuse abdominal pain, may be all. The patient does not point to the right iliac fossa. With tender, careful palpation the doctor will after all find the spot where the pain is most marked. The appendix migrates to other points of the abdomen when high cholecystitis or retrocæcal pain may be worst or the kidney may be suspected, or in women the appendages may appear inflamed. Vomiting may be absent, but some nausea is practically always present. Parietal contraction may be insignificant, but is generally present to some extent. Diarrhœa is sometimes profuse and may replace the classic constipation, even in cases which are not hypertonic. Fever and tachycardia may lack in acute appendicitis, but is generally present. Even in severe cases the pulse may be rapid with almost normal temperatures, or the reverse may be true, for instance temperatures of 39° or 39.5° C may be associated with a pulse of 50, and when the pulse becomes normal again it may be about 70 or 80. But one symptom, severe pain or a point of maximum pain, is always to be found in appendicitis, not, however, always in the iliac fossa—Michel and Guibal recommend operation as soon as the diagnosis of appendicitis has been made in a pregnant woman. Generally there is violent pain upon pressure at McBurney's point, which must be carefully palpated and all other transferred pain eliminated. Genital symptoms must be carefully barred. The pains are generally sudden and violent and retention of fæces almost always present. One of the difficulties is that the physician will be inclined to give sedatives to a pregnant woman whenever such violent pains occur before term. These sedatives may cause fæcal retention and make the diagnosis more difficult. A number of successful operations of the appendix have been reported, and only in a few has premature expulsion of the fœtus been seen a few days after operation. Prognosis should be most guarded where there is a suggestion of perforation and it is absolutely bad when there are a septic diarr' and 'ting of bl.

Appendicitis must be considered unfavorable in general during pregnancy. The fever may produce abortion. Inflammation and pus may become diffuse. It must be remembered that 80 to 90 per cent of cases of appendicitis may heal without operation, but after the diagnosis has been made the treatment should be surgical.

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- WALTER, ZWEIG "Synopsis of Intestinal Diseases, VII Appendicitis," *Deutsche med Wchnschr.*, vol 55, p 1424, 1929

What opinions are held on the relation between spina bifida and enuresis?

The causes for enuresis given in the older literature are infantilism, hypothyroidism, congenital syphilis, adenoid vegetation, intestinal worms, neuropathies, testicular ectopy, etc. There is evidence that malformation of the sacrum may cause symptomatic incontinence of urine and in some instances a malformation of the lumbar vertebrae was found. In the material of Jacobovici and Urechia, taken from the deaf mute institute and other children's welfare institutes, showed localized hypertrichosis, tenderness or pain upon bending and extension of the spinal column, and some had slight depressions in the sacral spine (the much admired sacral dimples sought by the artists of former centuries). Spina bifida was found in all but three of nineteen cases, aged from four to sixteen. In some instances the lack of bone formation reduced the vertebral arches to cartilaginous bands. The dural sac extended below the normal level in a number of the children. Bands were attached to the bone of the spinal column, and the dural sac, or there was dilation of this sac. Surraco found slight pollakiuria in young individuals between infancy and adolescence, who had a spina bifida, with an impressionable bladder. At night this caused the syndrome called essential incontinence. During the day there was an urge for micturition or running of urine, caused by agitation, laughing, running, and coughing. During the second stage of this condition there was dysuria, and probably some retention, and during the

more advanced stages there was pronounced periodic incontinence. Other writers have considered this condition of enuresis an irritation of the sexual organs and believe that dealing with the children energetically would help them to overcome this difficulty. Hamill recommends that children be roused three times at night and compelled to pass water. However his results showed only a low per cent improvement.

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- LANCET "Spina Bifida Occulta of the Fourth, Fifth, and Sixth Cervical with Syndrome Simulating Pott's Disease," *Bull. Soc de péd de Paris*, vol 27, p 194, 1929
- SURRACO, A. "Spina Bifida and Syndrome of False Incontinence of Young People," *Jour d'uroi*, vol. 27, p 15, 1929

How is pregnancy diagnosed biologically?

Pregnancy was diagnosed from the urine three or four thousand years ago. Newer investigations of Aschheim and Zondek have shown that during the first months of pregnancy the urine of women stimulates follicular maturing in the ovaries of mice. Subcutaneous injections of urine of women into immature male mice taken during the first two months of gestation produced hypertrophy of the entire genital tract, especially in the accessory glands, making them appear like those of the adult. In the adult male, weight and volume of the testicles were increased and a spermatid fluid rich in spermatozoa was found. This phenomenon was developed into a test for diagnosis of pregnancy. The Aschheim and Zondek test does not make it possible to differentiate between pregnancy and tumor, and other diseases of the genito-urinary apparatus, according to Hansson. He used thirty urine specimens and controls of non-pregnant women. Aschheim and Zondek considered six to eight grams sufficient for their tests. Hansson believes that ten to twelve grams are necessary. This writer has proven that urine from women, certainly not pregnant, and in some cases without other pathologic changes, but with slight swelling of parts of the genital organs, due to spontaneous forming of ovarian hormones, both in children and adult females, produced the same reaction. He verified this by autopsy.—The Aschheim-Zondek test in

Hansson's modification of employing more urine permitted of distinction between uterine tumor and pregnancy. Changes were found in the infantile genito-urinary system, and in the non-pregnant. Of twenty-seven cases, seventeen were diagnosed as definitely pregnant from two to nine months, four were doubtful and six distinctly not pregnant. In all seventeen cases of established pregnancy, swelling of the genito-urinary organs was considerable, and dot-like bleeding of the corpora lutea could be demonstrated. Three of the four doubtful were in heat, but the six non-pregnant had some pathologic anatomical changes.—To Botschkareff the experiments made with the Zondek method at the Institute of Experimental Endocrinology at Moscow, proved the theory of the originators of the test to be correct, which shows the anterior hypophyseal lobe hormone superior to the general sex hormone. The latter, he found, excited the sex glands into production of hormones. He produced sexual maturity in infantile mice one hundred hours after the first injection of mouse hormone, œstrus and hæmorrhagic spots or corpora lutea in the ovaries. Œstrus was not produced in castrated mice by hypophyseal hormone, but by ovarian hormone. No œstral changes were seen in the vagina of mature females after injection of anterior lobe hormone, but increased luteinization of the ovaries. The same quantity of hormone in infant mice produced marked enlargement of the testes and increase in seminal vesicles. No such increase ensued in castrated males. Large normal males are scarcely at all influenced by the hormone.

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FLUHMAN, C F "Anterior Pituitary Hormone in the Blood of Women with Ovarian Deficiency," *J A M A*, vol 93, p 672, 1929

HANSSON, CH. E "On Aschheim and Zondek's Pregnancy Test by Demonstration of Anterior Hypophyseal Lobe Hormone in the Urine of the Pregnant," *Svensk farmaceut tidsk*, vol 33, pp 333 and 349, 1929

What is the cause of puerperal fever?

Puerperal fever used to be considered a zymotic disease and contagious among lying-in women. Fatal epidemics were reported in all the larger cities of Europe in the sixteenth and seventeenth centuries.

The beginning of the twentieth century postulated antiseptic preparation of the doctor but not of the patient—At present puerperal fever is always considered the result of an infection with predisposing influences from anything that will depress the vital forces such as overwork, mental worry, or surroundings with bad sanitary facilities, or preexisting diseases, latent gonorrhœa, vaginitis, cervical erosions, and renal disturbances, also faulty diet The microorganisms, which are blamed, are streptococcus, the pathologic agent of scarlet fever, pneumonia, colon bacillus, staphylococcus, gonococcus and treponema—It is often hard to tell what ails the patient when she develops chills, fever, and sweating, and generally streptococcus is considered present, or malaria fever William Moore considers it the best policy to give antistreptococcal serum at all events in doses of fifty cubic centimetres followed by three to ten grains of quinine every three hours—The pregnant should be examined from the beginning and her surroundings investigated at her own home if possible She may have been exposed to infections of scarlet fever, erysipelas or gonorrhœa After delivery the placenta must be carefully investigated, also the perineum and cervix for lacerations Prevention is the only way of safety Both the patient and the obstetrician should avoid contact with infectious diseases If those attending the confinement are obliged to come in contact with such diseases—which should not be the case—especially careful asepsis is imperative.—The majority of investigators believe the placenta to be the source of poison in the toxemias, which occur earlier in pregnancy The lowered incidence of eclampsia during the war had suggested diet poor in proteins and alimentary treatment for the elimination of toxins, and many of the infections are now attributed to outer conditions more than to obstetrical reasons—More antenatal beds are being provided in the maternity hospitals Antenatal care will help avoid puerperal sepsis—Von Heuss attributes eclampsia to more remote environmental conditions In fact he believes that the incidence of eclampsia which showed a marked increase from 1908 to 1922, where 367 cases of eclampsia among a total of 1700 were attributed to cold waves On normal days 0.25 cases were registered, but on days with atmospheric disturbances 1.2 He shows that there is an overstimulation from cold after drops of temperature of six degrees in twenty-four hours Cooling binds the hæmoglobin to the oxygen, there is an inhibi-

tion of oxidation by too little CO_2 and, according to Haldane, a too close binding of oxygen to hæmoglobin. During pregnancy the carbon-nitrogen quotient becomes greater so that carbon cannot be oxidized sufficiently and a CO_2 deficiency results. This vicious circle is aggravated by increase of respiration from lack of oxygen. Increase of cold produces a vasomotor irritation from increase of vascular permeability with swelling of the brain and kidneys, which need much oxygen. The increase of irritability of the nervous system may ultimately exceed compensation and eclampsia is caused. Von Heuss admits that there are accessory causes in the diet employed in large cities, and the great changes in temperatures in certain cities of the United States.—This influence of the temperature of the air upon infections has been studied experimentally by Friede and Shukow-Wereschnikow. Increase of the temperature of the air had an astonishing influence upon the resistance of frogs as cold-blooded animals to heterogeneous albumin or erythrocytes. Frogs kept at twenty degrees in the thermostat acquired infections with *Bacillus septiciemise ranarum* sooner than those kept at ten degrees C. The animals kept at the unaccustomed temperature succumbed much more readily. Inactivated cultures produced the same result. Normal defense bodies appeared to be paralyzed.—Carl Henry Davis, with many others, considers puerperal fever as caused by chronic gonorrhœa in most cases where it comes on during the second week of the puerperium, rarely before the tenth day. This type of infection is apt to create the one-child sterility.

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MOORE, WILLIAM "Puerperal Fever," *Jour Indiana State Med Assoc*, vol 22, p 356, 1929

What have some of the newer studies of metabolism as related to ovarian function revealed?

The metabolistic changes observed during pregnancy are similar to those found during menstruation and whether or not the ovum is fertilized the secretory preparations are the same during the intermenstruum as before pregnancy, by bursting of the follicle to formation of corpus luteum. Schepetinsky examined sixty healthy women, aged from nineteen to thirty years, during the premenstrual period. He found the calcium content somewhat increased but not beyond the upper limit of normal. During menstruation the calcium content varies within normal limits. The potassium content shows increase in some cases, while the content of inorganic phosphorus remains within the normal limits in the premenstrual stage and during menstruation. The sodium content is markedly diminished and the chloride content relatively low during menses. In primary and secondary amenorrhœa, denoting hypofunction of the ovaries, the calcium, phosphorus, sodium and chloride contents are normal, and the potassium content considerably decreased. In the climacteric period the calcium, potassium, inorganic phosphorus, and sodium contents remain normal, but the chloride is decreased. Fluhmann has shown that the anterior pituitary hormone in the blood of women with ovarian deficiency is decreased and similar studies have been made by Smith and Engle, and Zondek and Aschheim, and Evans and Simpson have written considerable about the gonad-stimulating hormone—The more tangible manifestations of the effect of ovarian function on the metabolism, or *vice versa*, are seen in the clinical manifestations. Dyspepsia is quite frequent at the time of puberty in anæmic girls or during menstruation often associated with vomiting and intestinal disturbances. Constipation is apt to start between the ages of sixteen and twenty years. Associated with it during the menses is fatiguability, psychic instability, vasomotor disturbances, perspiration, salivation, tachycardia, increase of acidity of the stomach or the duodenum and aggravation of ulcers in these parts of the intestinal tract—During the climacteric stage there are often œsophageal and gastric spasms, dyspepsia, and gastro-intestinal hæmorrhages. There is a close relationship between the gastro-intestinal canal and functional disturbances of the sex organs. Even in the male marked irritability and depression are seen with the

close of sexual life in the fifties, and though the symptoms may be mild in some discomfort may be severe with insomnia, headache, asthenia, both neuromuscular and mental in other instances. Many women between the ages of forty-five and sixty suffer from recurrent headache, which is generally frontal, or on the vertex, generally dull, every day or two or three times a week, though rarely severe, vertigo is common and the memory may be impaired. There is a state resembling a mild myxœdema, evidently a hypothyroidism.—In experiments extirpation of ovaries occasions inhibitory processes in the nervous system, consisting of decrease of reflex excitability. Castration of female dogs produced fluctuations of the total amount of secretion during the digestive period. The ovarian influence of the gastric secretion is mainly through the nervous system. Duration of secretion is shortened after castration. During pregnancy there is an increase of secretion and acidity of the gastric juice, and it is greatest during lactation immediately after delivery. After a few weeks it returns to normal. Good results have been reported in overcoming climacteric discomfort by roentgen castration. It is evident that with cessation of the ovarian function shrinkage of other portions of the genital tract are most marked. In two-thirds of women the internal os is completely closed or much contracted, only one-third remained unchanged. Such anatomical changes of senility cannot be expected to remain localized, and the interchange of functional failure produces a complex picture. It is significant that at this time many of the neoformations develop.

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What is being done to control rheumatism?

Since the British Ministry of Health called the attention of the profession to the problems associated with rheumatism in 1923 much thought has been given to the causes and remedying of this condition. Among industrial workers of England, northern Europe, Holland, and some parts of the United States, rheumatism is a serious source of disablement, suffering, and economic loss. For a long time almost all cases were attributed to gonorrhœal or syphilitic infection, but many other factors had been recognized as entering into its production. Both public opinion and the profession have been educated better in recognition of the underlying causes and the methods of avoiding it in everyday habits—Archer describes the various forms of arthritis attacking middle age. The arthritis of menopause is seen chiefly in obese middle-aged women just at or after menopause, with grating knee-joints and Heberden's nodes, it is of non-infectious origin. The average weight of these patients at the age of fifty-six years and a height of five feet and two and one-half inches has been found to be 172½ pounds, while the normal weight for this age, sex, and height is 141 pounds. A series of infectious cases of arthritis studied by the same author showed slight underweight, and the menopause group had rheumatism seventeen years before the infectious group. Diminished sugar tolerance was found. This is different from the infectious cases, which but rarely show lowered tolerance for dextrose—One of the complications of arthritis which has been rather thoroughly studied is the rheumatic heart. It comes more and more under institutional treatment and there definite diagrammatic records help to understand the cases better. Much has been gained in examining these patients in various positions, which changes the transmission of sound—The International League against rheumatism is investigating the statistical side of the question. Much has been done with physical treatment and spa hospitals. The bad effects of climate and housing have been thoroughly appreciated, especially in Eng:

The British Red Cross Society is doing much good work in bettering the conditions of laborers who are obliged to work in damp places

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What are some of the newer experiences made in connection with lumbar puncture?

In a series of 250 routine examinations of the cerebrospinal fluid of neuropsychiatric patients, both adults and children, Gordon found a relation between the cerebrospinal fluid and the body temperature. In fact he believes that the cerebrospinal fluid must have a direct relation to the heat regulating centres. Body temperatures were taken before and within three hours after puncture. Elevation of temperature commenced a few minutes after each puncture. If no fluid was obtained no rise in temperature occurred. The cause of so-called dry lumbar punctures, Carter sees in either pathologic thickening of the fluid or there may be a simple obstruction by a clot in the needle. On the other hand, there may be a low local intrathæcal fluid pressure for some reason. There is another possible impediment which may arise from displacement of the theca by the needle, which may enter into one of the attachments or ligaments, or the theca may adhere to the nerve roots. The latter may float against the needle. However, the cauda equina lacks motility—Lumbar puncture, which is becoming ever more routine, shows a great number of anatomical points so far not appreciated. Recently, an interrelation between the tension of the cerebrospinal fluid and that of the eyeball has been seen. Normal subjects show no definite relation between the tension of the two. Often both are high but one may be low and the other not. A slight hypertension has been found in both during menstruation. For several months there may be an increase in cerebrospinal fluid tension of five to ten centimetres of water or from four to five millimetres of mercury on the tonometer. During attacks of melancholy the cerebrospinal fluid tension

is very low, so is the ocular, and they become normal upon recovery Lamache and Dubar believe that severe changes in the water metabolism are the cause Schousboë observed a case of anomalous venous circulation of the retina with cerebrospinal hypertension in a tabetic who did not present engorgement of the papillæ. There was probably intracranial hypertension with slight œdema of the retina The pressure of seventy to 120 of cerebrospinal fluid indicated a cranial hypertension as a meningeal reaction, though there were no clinical symptoms This latter feature is rather characteristic of tabes

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LAMACHE, A., AND DUBAR, J "Report of Tension of the Eyeball and Tension of the Cerebrospinal Fluid," *Bull de la Soc d'Ophthal de Paris*, p 158, March, 1929

SCHOUSBOË, F "A Case of Anomalous Venous Circulation of the Retina with Cerebrospinal Hypertension without Engorgement Papilla in a Tabetic," *Bull Soc d'Ophthal de Paris*, No 5, p 278, 1929

How is bacteriophage applied?

Dr André Raiga uses a few drops of a one per cent polyvalent bacteriophage with success in dental ulcers It is injected into the punctured collection of pus Pain and trismus ceased almost immediately and the lesions disappeared rapidly though they had resisted other treatment In three of his patients he discovered an enterococcus infection, they did not recover as rapidly as other cases of the same group, Doctor Raiza thinks because enterococcus produces acid soil on which the bacteriophage cannot act It requires an alkaline medium, with the bacteriophage bicarbonated serum is employed Professor Gosset has collected 335 cases in which bacteriophage d'Herelle was used—d'Herelle considers bacteriophage a living ultramicroscopic being, as it propagates in heterologous surroundings, maintaining its characteristics It can adapt itself like other living beings, it varies, and after continued inoculations it retains its identity d'Herelle considers the body of the bacterium heterologous Many other writers do not consider it heterologous to bacteria, but that it secretes something as a reaction to a substance called bacteriophage and is present in all bacteria, and that it has not the lytic properties of normal bacteria, which are rendered abnormal by bacteri-

When abnormal it produces the lysin called bacteriophage by d'Herelle—Flu examined the waters near Leiden and Rotterdam, especially the pest bacteriophages and coli and Shiga bacteria, which in fifteen passages maintained their effect. This demonstrated the living nature of the bacteriophage. A living substance, Flu argues, would not act like a virus, passing from one individual to another and maintain itself for a longer or shorter time, which would be like an epidemic or infectious disease—Grenet and Isaac-Georges believe that it is necessary to choose microbic species which have homogenetic features with the bacteriophage. A strain of virulent bacteriophage, they think, would be so for all individuals of a species. They believe not each one need be tried *in vitro*, for instance in dysentery or pest. Different strains of staphylococcus may be employed as stock bacteriophage. They found that coli and typhoid bacilli failed, but believe, however, that there may be strains which are capable of destroying them. In chronic cases symbiosis of long standing may cause a modification of the germs in contact with the bacteriophage. Grenet and Isaac-Georges give massive doses, ten to twenty cubic centimetres by mouth and simultaneously two cubic centimetres under the skin for typhoid. For urinary infections they inject ten to twenty cubic centimetres into the bladder. For staphylococcus infection, one to two cubic centimetres are injected under the skin and local compresses made with bacteriophage. Good results were obtained in the urinary infections, but only in one of seven cases of typhoid were they satisfactory.

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GRENET, H., AND ISAAC GEORGES, P. "Bacteriophage of d'Herelle," *Presse Méd*, vol. 34, p 1089, 1929

PARIS correspondent "The Successful Use of Bacteriophage in the Treatment of Phlegmons of Dental Origin," *Jour Amer Med Assos*, vol 93, p 706, 1929

Are leeches used in present-day therapy?

Blood-letting has never quite ceased though for the last fifty years it is not often admitted, or has very restricted indications at least in the large clinics. But every now and again one hears that someone claims good results. Leeches are kept in some of the pharmacies of the Old and New World but one does not hear doctors

speak of them. Just recently G. A. Tholen has reported good success in the post-operative treatment of complications following surgical treatment of thrombophlebitis. Within an average of three days, in from one to six days, local improvement was seen from the application of three leeches, and the general thrombophlebitis was cured in from three to twelve days, with an average of six days. The cessation of the pulmonary embolus in one case was followed by a thrombophlebitis, first of one leg, and then of the other, yet all was healed within thirty days.

THOLEN, G. A. "Treatment of Post-operative and Puerperal Thrombosis and Emboli," *Wien Klin Wchnschr*, Vienna, vol 42, p 1107, 1929

What damage is done to the ears by bathing?

Many acute aural conditions are the result of bathing and the consequences may be serious. There are healthy bathers who may be imperiled by others who have septic nasal conditions, including common colds, such with perforation of the tympanic membrane, with recurrent dermatitis or furunculosis of the external auditory meatus. When water gets into the meatus wax swells and tinnitus and occlusion follow, or the water accumulates behind the wax and causes discomfort or infection. Rolled towels used for drying the ears press the accumulated wax in tighter. Acute otitis media may attack the healthy swimmer from infected water entering the Eustachian tube and the middle ear tract. The city water is especially dangerous and beaches with many bathers and refuse accumulation, less so the mountain streams. Not in all countries are the bathers compelled to wash with soap and water before entering the common bathing pool. All those suffering from colds should be barred. Saunders believes that exercise gained by swimming by far outweighs the possible detriment sustained by lack of caution of normal persons. Trauma to nose and ears should be carefully avoided, and in diving the nose should be firmly closed. The swimmer must breathe correctly while in the water.

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SAUNDERS, G. C. "Sinusitis and Otitis in Swimmers," *Am Jour Hyg*, Baltimore, vol 10, p 253, 1929

Has the clinical use of vitamin A been worked out?

Vitamin A is a liposoluble substance contained in large quantities in butter, algæ, carrots, spinach, animal oil, and yolks of eggs. It is indispensable for the development of the adult. Pagniez has shown that rats deprived of it develop xerophthalmia and even corneal ulcers after a certain time, with subsequent panophthalmia. They lose their appetite, and the skin becomes poorly nourished, they suffer from diarrhœa and become emaciated. In the human the pathologic changes of the eye taken on the form of keratomalacia in children. The Japanese describe it as hikkan, characterized by bloating of the abdomen, diarrhœa, emaciation, dryness of the skin and hair and conjunctival xerosis. These eye conditions which may go on to blindness are cured by cod-liver oil.—The lack of vitamin A manifests itself in a tendency to nasal and bronchial catarrh and urinary calculus. Mellanby and Green have associated this deficiency with an autoinfection. Experimental animals were given a diet of casein bases, amidon, sugar, olive oil, citrus juice, and various mineral oils. In the human this diet cured puerperal fever, septicæmia, hæmolytic streptococcal infection, sterilization of the system of the infections being achieved in one or two weeks. The fever disappeared and the rest of the symptoms yielded.

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Medical Trend

By HENRY W CATTELL, A M , M D

Editor of INTERNATIONAL CLINICS, Burlington, New Jersey

Service is the rent we pay
For our space wherein to stay

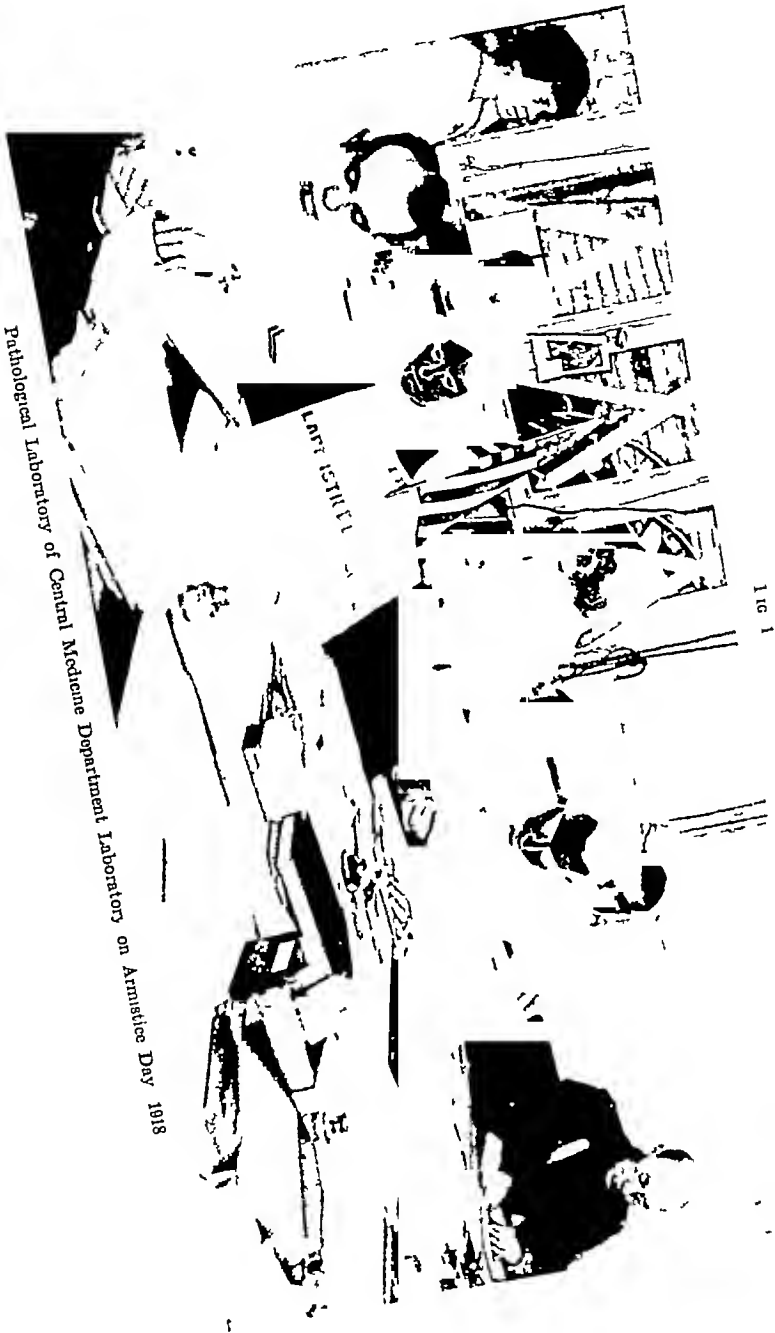
WITH a stop-off-when-and-where-you-please railroad ticket—by actual measurement 31 inches in length—from Philadelphia to Denver, via Washington, D O , and Lincoln, Nebraska, and return via Omaha, Nebraska, and Rochester, Minnesota, I made an interesting and instructive observation-and-talking trip during the latter part of September and the first week of October of the present year. The results are already evident in this number of the INTERNATIONAL CLINICS by the excellent symposium on tuberculosis from the Fitzsimons General Hospital of the U S Army, which starts the volume, and by examples of the mental pabulum, to be given later on, which is being supplied day in and day out to those fortunate enough to be associated with the Mayo Clinic and the Mayo Foundation. And many good things are still to come in the way of future articles promised for 1930 as those by Dr Donald C Balfour, of the Mayo Clinic, on a survey of the surgical progress throughout the World and by Professor George Frederick Dick, of Chicago, on the present status of his epoch-making studies in scarlet fever. During the coming Winter I plan to make a personal study of medical conditions as they exist in the South and on the Western Coast.

THE ELEVENTH HOUR OF THE ELEVENTH DAY OF THE ELEVENTH MONTH OF THE ELEVENTH YEAR AFTER THE ARMISTICE

The fact that the Fitzsimons General Hospital, of Denver, Colorado, a well-planned, delightfully situated, ably managed hospital, is named after the first American to be killed in the World War, reminds me of the care taken in the burial of soldiers and nurses in the A.E.F. during the latter part of 1918. While in charge of the

Pathological Department of the Central Medical Department (Fig 1), at Dijon, France, I was also pathologist to Base Hospital No 17, situated there, and under my superior officers, Colonels Siler and Wilson, looked after an art unit sent over from America consisting of five medical artists, two motion-picture men, and one photographer. Thus Captain ——— was buried with military, masonic, and Jewish ceremonies. The coffin, carried on a caisson, draped with its American and French flags, drawn by four horses, was escorted to the cemetery by cavalry and eight pallbearers of equal or superior rank, and at the grave the impressive masonic forms and the Jewish ritual, the sounding of the bugle and the firing of the salute, afforded a most solemn and long-to-be-remembered setting for a motion-picture scenario taken by the camera men, and Miss ———, a nurse of the Detroit Unit, received honorable care when she died. These films were to have been shown in America had the war lasted longer than it did, but fortunately on the eleventh hour, of the eleventh day, of the eleventh month of 1918, the armistice was signed.

In this number of the INTERNATIONAL CLINICS we introduce to our readers a well-known British medical artist, Mr A Kirkpatrick Maxwell, who, as a Corporal, made his reputation while serving as the official illustrator of the R.A.M.C. and the Medical Research Council, his colored reproductions on gas poisons being the best of their kind brought out during the World War. We have much to thank the many non-commissioned men for their good scientific work during the war, and this, too, for a minimum amount of money, paying at times for their own billet and then to be often handicapped by army red tape in the performance of their work. Thus while serving under Colonel W O Owen, at the Army Medical Museum in Washington, D C, in the Spring of 1918, we had Paul Terry, of Aesop Fables fame and fortune, in the Motion Picture department and another Sergeant who after the war employed both Colonel Owen and myself for pay in some photographic work in which we were all interested. In my own department, in the Chief Surgeon's office at Dijon, France, under Colonel Siler, there were two corporals and a like number of sergeants whose combined yearly income before their entrance into the war had been about nine thousand dollars and they were serving at a little over a dollar a day and their upkeep. Many a one has read the book "Sorrell and Son," or



Pathological Laboratory of Central Medicine Department Laboratory on Armistice Day 1918

seen the motion picture by the same name, and realized his own situation after the war was over

Before leaving this subject of the World War, let me give a translation of a letter received from a fellow editor, Dr Hermann Berger,¹ of Furstenberg, Mecklenburg, Germany, who is well qualified to discuss medical conditions in Germany, both as to the past and present, though his comparison of conditions existing here are by no means always accurate

The present situation of the German medical profession is the result of the development of the German nation in general in the last half century. Our American colleagues who have a desire to understand us have to have the gift of entering into a foreign world which it is difficult to understand. It has little in common with American conditions either economically or as regards the national psychology. Even long before the war the German middle classes experienced a marked reduction of prosperity, and since the war have been impoverished to an extent that a doctor who had to depend upon this class for a livelihood could not exist. The number of "wealthy" people has been reduced to a very small number. The living and earning conditions of the American laborers are entirely different from those in Germany where at all times the (average) workman earned only enough to live from hand to mouth, only just supplying his own and his family's modest requirements—as long as he had work. There could be no thought of extraordinary expenditures, or saving. When he got old, or ill, or, if employment failed, he and his family faced privation, and misery. Pay for doctor and medicine? Whence should he take them? These were the reasons why social insurance—for old age, sickness, accident and invalidity—and recently against unemployment—have been introduced by us for workmen and employees. A peculiar psychologic attitude of the population entered into the equation in this decision. With us migration of laborers and change of occupation are not common occurrences while they are a matter of course among the American employees and which are in their blood,—possibly for the reason that immigration has an extensive influence upon the labor market such as does not exist in our country. The German laborer prefers being settled to a much greater extent than he does in your country. The normal and respectable laboring man does not quit his job except for compelling reasons. In this manner a sense of belonging together has been developed between those who give work and those who take it, and between the workman, his home and municipality or township. And just as the laborer and employee is attached to his homeland, the home government recognizes its duty toward the laborers of its district. A "personal" emotion element is involved which, if I am not mistaken, is foreign to Americans.

Social insurance, then, has not developed from socialistic tendencies but has sprung from a human sense of attachment and responsibility felt by the classes which at that time were called "lazier," and the government administration. It cannot be denied that all political parties, the so-called liberals, the national

¹ Formerly editor of the *Medizinisch Literarische Zentralstelle*

liberals, which were more to the Right, the Church party and the Central parties all coöperated with those of the Left, the social democrats thirty years ago. Probably the Left exerted a certain amount of effective pressure for a more rapid development of the problem. However, the social democrats were not the originators of these insurances, for the simple reason that they did not have sufficient power in hand at that time. The German nation was the father of the social insurances including the "upper" classes, and actually being led by them. But what does the term "social democracy" signify for gentlemen of the American profession?

My introductory remarks are getting somewhat lengthy, but what would be the advantage of trying to speak to you of our medical professional difficulties without a capacity on your part to appreciate the soil from which they have sprung and where they have thrived?

The theoretical principles of "Marxism" are known, after all, only to those immediately interested in them (to be frank, I don't understand them myself). And you, my colleagues across the water, lack personal knowledge of active social democracy, if I understand your country correctly—at least only to a small extent, or not at all,—and you are lucky. Where ideas and feelings are democratic "equal rights for all" are deeply inherent in the blood, as is the case in your country (for your republicans are not any less democratic in sentiment than your democrats). Therefore you need no social democracy. You who know no other aristocracy than that of the capable can hardly imagine what enormous psychological effect the aristocracy of birth, which has been predominant in our country for untold centuries, has produced in our country and what enormous antagonistic powers are at work now, and from a human ethical standard possibly have to be exerted in order to crowd back both effect and cause into limits which are humanly appropriate. The rebound of the pendulum in the opposite direction is too great and but the working of a biologic physical law. You see, gentlemen, it will be difficult for you to understand why we of the German profession take matters so seriously which to you may not seem world moving. I sincerely beg of you to muster understanding and comprehension, or what I wish to say must seem mere hollow phrases to you. The power of sentiment which I mentioned above is manifest in the professional life of the physician, each one individually and the profession as a whole feels a profound inner emotional bond uniting him to the patient, whom he is treating, and just as profoundly an emotional response is felt for the common public welfare, by no means as a duty or for a purpose only, and not at all from a monetary bias but associated with the prosperity of the populace of town and province. This is the reason why over here problems make the brain work feverishly and the heart beat warmer, while other nations dispassionately using their brains often solve the problem quicker, and, we admit, often better. This is what our most read medical writer, Dr. Liek, of Danzig, so aptly and with deep feeling calls the doctor's mission ("Des Arztes Sendung"). It is a sacred pledge for our entire professional conception. Our "sending" forms the core of our professional ethics. And this is the very reason why the great majority of us smart under the advance of the social democratic principles in the public administration of the sickness insurance institutions.

The social democrats want to do away with the individual human conception of our professional duties. According to their reasoning, patients should

cease to be the suffering mankind for us. They are to constitute nothing more than a minus item in the governmental appropriation, though indeed not less than that. It is in the interest of the government to eliminate all minus items and to forestall them. Sympathy? Sympathy of the doctor for the physician? Very well, providing it does not interfere with politics and does not cost the government anything, if not, away with it! Politics—this is the borderline which causes us to censure our social democratic colleagues most severely. A social democrat intends to gain ever increasing territory for his political prestige. Social democratic members of the profession and especially the sickness insurances let themselves be exploited for expansion by their political party without consideration as to whether socialization harms the patients and the doctors as well or not. We, however, the overwhelming majority of German physicians—more than 90 per cent—do not tend to socialism. We have the most serious misgivings that socializing the sickness insurance institutions must be detrimental both economically and ethically to the German nation, and is bound to harm the doctors extensively. This is the fight which is waged.

The great majority, in accordance with the leaders of the large organizations, does not deny unselfish recognition to the great benefit which the insurances have brought to the population in spite of dubious influence on the laboring classes. But we know very well that the meager margin of professional liberty and economic independence which remains is to be credited to our defense actions. Had we not accomplished the enormous task of uniting all doctors on the staffs of sickness insurances in the "Leipziger Verband" for protection of our economic interests and the "Hartmannbund" to which probably nine tenths of all German physicians belong. If we would lag but a second in our intense vigil or falter in our continued battles we would forfeit without recovery one hold after another on what is left of our professional liberty.

We would work with more satisfaction at the perfection of the existing sickness insurance institutions if there were not danger of constantly progressing socialization of the bulk of German sickness insurances. Everybody, I think, agrees that they fall short in many respects in their present form.

It would lead too far to relate all the attacks launched against the General Sickness Insurances and to investigate their right to carry on or not in making slaves of doctors, vitiating the more particular service rendered to the patient by overworking the physician with administrative mechanical records, breach of professional secret, rendering mechanical the routine examination and treatment of patients, etc.

If one looks at the problem considering the population as a whole the following seems the most important question. Has sickness insurance produced a decrease of morbidity? As I have mentioned above, there has been an actual demonstrable reduction of recent decades not only of mortality, but also of morbidity incidence of certain common diseases, such as tuberculosis, venereal diseases, and others. However, the factors to which such a decrease is to be attributed are so many and devious, that it is hard to decide which is the part of each one. On the other hand these are undeniable facts. Patients are bred there is an unwarranted tendency of those subject to compulsory insurance of wanting to be declared too sick to work without being actually sufficiently ill to stay away from work. The fault for such lack of morale is attributed by us physicians to compulsory insurance, while the officials of the sickness insurances

reciprocate by laying it at the door of the doctors. A hot fight is going on regarding this question, the cultivating of sick dole beneficiaries, and the means of combating this. It is a war between doctors and large strata of the population.

THE MAYO CLINIC AND THE MAYO FOUNDATION

The greatest æsculapian clinic, laboratory, and workshop in the world today, perhaps of all time, is to be found at Rochester, Minnesota, which town the Mayo brothers put on the map. To me they have always seemed like twins, united more like those of the Siamese, so closely have they interwoven their epoch-making life-work, the one with the other. The historian a hundred years hence will have difficulty in differentiating their personalities, but still more so in separating the Mayo Clinic from the Mayo Foundation for Medical Education and Research, of which Dr. Louis P. Wilson is the Director, closely united in more ways than one with the head of the division of publication of which Mrs. Maud H. Mellish-Wilson is in charge. Those interested in a full history of the Mayo Clinic and the Mayo Foundation will find the work published by W. B. Saunders in 1926 of great interest, but since then many improvements have been made in the plant in the way of buildings, equipment, and improvements in office technique.¹ Those of you who keep your volumes of the *INTERNATIONAL CLINICS* will find in Series 24, Volume 12, 1914, a specially illustrated article of conditions as they then existed by Mr. Erwin F. Foher, of Philadelphia, who made the art drawings for the paper and has also illustrated the papers of Doctors Edward Martin Hergesheimer, Ferguson, and Loefflad in this issue of the *Clinics*.

To visit Rochester under the personal guidance of Dr. Louis P. Wilson—who spent the better part of two days with me—is a pleasure long looked forward to by the *Editor* of the *INTERNATIONAL CLINICS*, as we came to Rochester expecting much and got more useful information than we had anticipated. Dr. Wilson, an intellectual giant, capable of paying the minutest attention to details as when a physician is A. W. O. L. or an elevator man is not on the job, is interested in many things, but especially in firearms, for he is capable of making a gun from start to finish, and has just completed some valuable experimentive work for the Army at Washington, D. C.

W J MAYO'S REMARKS ON THE ANESTHESIA PROBLEM ¹

Chloroform was introduced as a general anesthetic by Simpson of Edinburgh, in 1848. When I began the practice of medicine, it was the anesthetic in general use. There was a feeling in the medical profession, and it may have been well founded, that if a patient were suffering at the time the operation was performed, so that the pain produced a greater effect on the patient's mind than the fear of the operation, chloroform, if given by the drop method on a little gauze frame, was a safe anesthetic. This was considered especially true of obstetric procedures. It was quite noticeable, however, that when chloroform was given for surgical purposes, the most responsible man gave the anesthetic. I was never quite sure whether this was because of his supposedly greater skill or whether it was to satisfy the relations and friends, if a catastrophe occurred, that everything had been done that could be done.

Chloroform was looked on as a special danger to the heart. On one occasion when I supposed that the anesthetist was using ether, two patients had failure of respiration from which they nearly died, and it was not until I was operating on the second patient that I noticed the odor coming from the anesthetic was that of chloroform and not ether. Through a mistake the bottle had been filled with chloroform instead of ether. In neither of these cases did the heart show serious reduction in volume or rate.

Ether was used first by Long and Morton, and became the popular anesthetic, but in the early days the A C E mixture was popular. It consisted of one part of alcohol, two parts of chloroform, and three of ether, and was given by the drop method on a little gauze frame.

Eventually ether became the anesthetic of choice, but at times it caused irritation of the bronchial tubes and throat, and usually was followed by nausea and vomiting. For short operations, nitrous oxide was popular, but gave little or no relaxation, and for abdominal work had to be combined with morphine or ether or other anesthetic.

Recent advances in methods of inducing anesthesia have brought in ethylene, a splendid and safe anesthetic, which is much less irritating than ether, but which does not always produce quite so complete relaxation. It can be readily combined with ether, or can be used to follow nitrous oxide, and although it has the disadvantage of being extremely inflammable, in a period of years we have had no accident of any kind from its use.

Acetylene has a small field of usefulness, especially for certain operations on the chest.

In those cases in which breathing is more or less interrupted during the administration of any anesthetic, Lundy has demonstrated the great value of the use of carbon dioxide to stimulate respiration.

Lundy and McCuskey and their coworkers have found the use of combinations of general anesthetics of various types, especially of ethylene with ether or nitrous oxide, in connection with local anesthetics, to be the procedure of choice in a very considerable number of cases.

In all cases, liberal amounts of oxygen have been found advantageous.

The lungs have nothing to do with inducing anesthesia, so far as sleep and relief from pain are concerned, except as an entry way which permits the

¹ Staff meetings of the Mayo Clinic for Wednesday, September 25, 1920

inhaled anesthetic substance to pass into the blood stream whence it is carried to the central nervous system. In this process irritation may arise in the lungs, possibly causing serious pulmonary complications.

With the new anesthetics, for instance, the sodium salts of the barbituric acids, and others of that type, we at least have achieved a scientific method of injecting the anesthetic intravenously, thereby relieving the lungs and other organs of certain dangers to which we have become so accustomed as almost to have forgotten the reason for their existence.

The Clinic is indebted to members of the staff, first to Dr. Sistrunk and later to Dr. Balfour, for making careful use of sodium iso amyl ethyl barbituric acid. This agent is not the perfect anesthetic, but in several hundred cases in which it has been used under the direction of Dr. Lundy and his coworkers, we have had no fatalities that could be traced to the anesthetic.

Our experience with sodium iso amyl ethyl barbituric acid demonstrates that direct methods of producing anesthesia may soon be expected, which, in connection with approved methods of inducing regional anesthesia, will relieve the patient of unnecessary dangers to unoffending organs. Certainly, as far as sodium iso amyl ethyl barbituric acid is concerned, the speed with which the patient drops asleep, and the freedom for some hours after operation from all painful sensation, has led many patients who have had unpleasant experiences with general anesthetics, to plead to be operated on under this newer form.

Regional anesthesia by procaine has a large and growing field of usefulness, and is very efficient and safe. Spinal anesthesia induced by procaine has proved of very great value in operations on those organs which lie below the diaphragm, and this form of anesthesia is the one that should be used in cases of intestinal obstruction, because in this condition, even if the contents of the stomach have been thoroughly removed by tubage previous to giving a general anesthetic, antiperistalsis may occur, regurgitating back into the stomach, esophagus and pharynx a quantity of intestinal secretions which may be aspirated into the lungs, causing fatal broncho pneumonia, or even drowning on the operating table.

Spinal anesthesia has the very great advantage in cases of probable intestinal obstruction, that if no true mechanical obstruction exists, gas and perhaps intestinal contents will pass by the rectum within fifteen or twenty minutes. Therefore, if gas and intestinal content are not passed after a spinal anesthetic has been administered, mechanical obstruction may be assumed to be present and advantage can be taken of the anesthesia for immediate operation.

ABSTRACT OF PROFESSOR LEON ASHER'S FOUNDATION LECTURE¹ ON "THE ACTION OF SPECIFIC DIURETICS AND KIDNEY SECRETION UNDER PHYSIOLOGIC CONDITIONS"

The researches on which Doctor Asher, Director of the Physiologic Institute of Berne, Switzerland, reported were not undertaken in the interest of the two well known conflicting theories of renal secretion but to find out which are the main factors controlling renal secretion under physiologic conditions. The first

¹ From the October 25, 1920, *Proceedings of the Staff Meetings of the Mayo Clinic*

step in these investigations was the examination of the action of so-called specific diuretics. So far as possible, the experiments were conducted under physiologic conditions. The urine of the animals (rabbits), for the sake of the employment of specific diuretics, was under controlled conditions of nourishment and allowance of water. It is essential for the success of the experiments that the animal is always in possession of sufficient and readily mobilizable water. The behavior of the animal in long-continued experiments must be known. Manipulations were not carried out except to adjust the animal on a board in a comfortable position, and to catheterize it. The specific diuretics were injected intramuscularly.

The first change observed after injection of the specific diuretics was a slight rise in the concentration of chlorides in the blood. After this, marked diuresis ensued, with a large output of water and electrolytes, especially chlorides. A careful investigation of the chemical and physicochemical composition of the urine and blood was made by Doctor Curtis, and he undertook an analysis of the cause of the increased renal secretion after the injection of specific diuretics. The first results suggested that an increase of sodium chloride in the blood was the main factor, an increase due to the change in permeability of the tissue cells in consequence of some activity. To test this suggestion, Doctor Curtis filled the peritoneal cavity with a slightly hypertonic solution of sugar. This procedure was followed by diverting the chlorides from the blood into the peritoneal cavity. This deviation, which was confirmed by chemical analysis, caused disappearance of the effect of the specific diuretic. Sources of error, for example, mechanical disturbances of the action of the kidney, were excluded by control experiments. To get rid of the secondary sugar diuresis, Doctor Curtis filled the peritoneal cavity with distilled water. Before undertaking these experiments, both kidneys were totally denervated to exclude reflex constriction of the renal vessels resulting from excitation of the sensory nerves of the peritoneal cavity. The action of the specific diuretics was readily abolished, but after equilibrium of electrolytes had been attained in the fluid in the peritoneal cavity a second injection of the specific diuretic produced the normal effect. The varied experiments of Doctor Curtis led to the conclusion that the primary action of the specific diuretics is on the tissue cells in general, and on the whole organism in the sense of Volhard's phrase "Vorniere."

To test the validity of this theory, experiments of Doctor Hartwich were conducted by adding to the solution of sugar some sodium chloride. The more sodium chloride was added the less was the diminution of the effect of the specific diuretic. Also a solution of urea injected into the peritoneal cavity caused marked symptoms of diminution of the action of specific diuretics, and again the partial replacement of electrolytes raised this activity.

To investigate the part which the kidney plays, according to the new view of action of specific diuretics, the kidney was experimentally put under conditions of a certain lack of oxygen. Lack of oxygen was produced by enlargement of the respiratory dead space. To exclude vasoconstriction, again the kidneys were totally denervated. Under these conditions, after injection of specific diuretics, the blood pressure was slightly raised, the renal volume enlarged passively, all electrolyte changes in the blood were present, but no action or practically no action of the specific diuretic could be observed.

These and various experiments led to the conclusion that the main factors

in the action of specific diuretics are the change in the electrolyte output of the tissue into the blood and the reaction of normal renal cells to the slight variations in the composition of the blood

Experiments of Professor Pick of Vienna have shown increased permeability of the central nervous system under the influence of specific diuretics. Therefore we had to examine whether there was an influence on the central nervous system playing a part in diuresis. That this may be the case was shown by experiments of Doctor McCaugh, who cut both splanchnic nerves and found that the specific diuretics had scarcely any more action. From this we conclude that in using therapeutic doses of a specific diuretic the change in permeability of tissue is primarily effected by excitation of the neurones of the splanchnic nerves.

Asher believes also that normal renal secretion is mainly regulated by interchanges between tissue and blood and the sensitivity of the renal cells toward these alterations, while filtration and reabsorption are further phenomena of laboratory experiments.

In cold blooded animals, for example the frog, a method was devised of a circulating system consisting either of the heart and kidney only or of the liver, heart and kidney. When the fluid flowed in the latter system, renal secretion was very much larger than in the former system, which shows that something leaves the liver to activate the kidney. All other conditions were held constant and urea or sugar was excluded as the cause of increased diuresis after passage through the liver. Whether the substance answerable for this effect is a hormone or something else has still to be found out.

ABSTRACT OF A MAYO FOUNDATION LECTURE BY PROFESSOR LEON
ASHER,¹ DIRECTOR OF THE PHYSIOLOGIC INSTITUTE, BERNE,
SWITZERLAND, ON "NEW FACTS IN THE PHYSIOLOGY OF
THE THYROID GLAND"

In a broad sense the principal functions of the thyroid gland are now tolerably well known. The point which at the present time is of principal interest to the physiologist who tries experimentally to study the pure physiology of the thyroid gland is the integration of the physiologic function of the gland from its single functional units.

The function of the thyroid gland which is best known, experimentally, and in many respects from the practical point of view most important, is its influence on metabolism. This influence is quite general. We have tried in our recent researches to find out which are the elementary factors of this phase of thyroid activity. The method which has proved satisfactory for this problem has been the use of a chamber in which animals could be subjected to lowered atmospheric pressure. The apparatus used was demonstrated. If, in such a chamber we put at the same time a normal animal, an animal fed with thyroid gland substance or with thyroid preparations for several days, and an animal in which the thyroid gland has been extirpated, and we gradually lower the atmospheric pressure, we observe that the first animal to show symptoms of a bad state of health and growing distress will be the one fed with thyroid gland. As soon as a barometric

¹From the October 9, 1920, Proceedings

pressure of about 350 mm of mercury is reached, we must be careful or the animal will die. The normal animal will show at the same time much less severe symptoms and the animal without thyroid gland will be the last to show anything abnormal as long as the experiment is not carried too far. This method, therefore, demonstrates that animals in a state of experimental hyperthyroidism have become far more sensitive to lack of oxygen, whereas animals with an experimental state of hypothyroidism are far more resistant than normal animals. To prove that it is the lack of oxygen and not the mechanical factor of lowered pressure, one need only modify the method and use appliances to lower the oxygen content and keep the pressure at a normal level.

The method can be used as a method of assay of the value of operations on the thyroid gland. It has been used by Professor De Quervain to examine the properties of blood of patients suffering from hyperthyroidism and from various forms of hypothyroidism. In all cases of hyperthyroidism the blood coming from the thyroid gland and injected into animals causes them to become more sensitive to lack of oxygen, whereas blood from the gland in cases of hypothyroidism gives negative results. This method seems to be specific because a trial with extracts of various other tissues or feeding with various other tissues did not give the same results. Single tissues, taken from an animal fed with thyroid preparation, show in Krogh's microrespirometer a large increase of oxygen consumption.

Clinical observations have led to the opinion that diseases of the thyroid gland are diseases of the constitution. If this is to be something definite, it ought to show up experimentally. For physiologists, the word constitutional means qualities of individual parts of the animal body which can be revealed if one uses the proper methods. If, under the influence of the thyroid gland, the constitution of the animal body is changed, it should be revealed in more or less each individual cell. A method was worked out to investigate constitutional alterations of individual cells. As individual cells we used the leukocytes, cells which have the great advantage of being isolated living units in the animal body. Through aseptic intraperitoneal injections we obtained the necessary amount of leukocytes. To test their state of functional activity the method of Hamburger and the more exact method of Fenn were employed to test the so-called phagocytic capacity. All conditions were held rigorously constant. The average phagocytic capacity of leukocytes of normal rabbits is approximately 36 per cent. If we now extirpate the thyroid gland the phagocytic capacity of the leukocytes of the same animals sinks to 7 to 9 per cent on the average. This is, therefore, a distinct constitutional change of individual cells. This change is due, in the first place, to changes in the leukocytes themselves, but in part, as could be shown by slight variations in the method, to alterations in the plasma of the blood. That this alteration in the phagocytic capacity is dependent on the thyroid gland could be demonstrated by simply feeding the thyroid gland substance or preparations to animals that had lost their thyroid glands and whose phagocytic capacity had been greatly lowered. We were able to bring up the phagocytic capacity again to its normal value.

Another well known function of the thyroid gland is its influence on growth, an influence which it exhibits not alone during the period of growth but also in the adult state. For examining the influence of the thyroid gland on growth in the adult state the observation of regeneration of the hair on the skin

of rabbits seemed to be suitable. If one shaves a large area of the hair from a normal animal, from an animal of a control series whose ovaries have been removed, and, lastly from an animal without its thyroid gland, and one observes the time of regeneration of the hair, the result is that at the time when, in the normal animal and in the animal without ovaries, complete restitution has been reached, the animal without a thyroid gland shows practically no restitution.

If the influence of the thyroid gland on growth is executed by an intestinal secretion, it should be manifested by qualities of the blood. A method to investigate this problem was worked out by observing tissue growth. If one compares the growth of embryonic tissue under exactly the same experimental conditions with the only difference that in one series the plasma used as part of the culture medium is taken from a normal rabbit and in the other case from the same rabbit after thyroidectomy, a marked difference in the intensity of tissue growth can be demonstrated. Therefore, the blood has undergone changes either in its chemical or physiochemical constitution through loss of the thyroid gland, which affect its capacity to induce growth. We may not for the present moment go so far as to say that it is lack of thyroxine in the blood itself.

One of the most controversial questions of thyroid physiology is that of the alleged influence of secretory nerves on the thyroid gland secretion. As an autonomic structure, according to the definition, the thyroid gland is, of course, capable of performing its functions without any connection with the central nervous system. This quality of autonomic structures does not prove anything either in the positive or negative sense as to secretory innervation. The older methods used to prove secretory innervation of the thyroid gland are open to certain objections which partially must be acknowledged. To make progress it is necessary to use other methods not subject to the objections to the former methods. The method employed consisted in examining the time of absorption of crystalloid and colloid solutions after injection into the connective tissue or into the muscles of the lower extremity of the rabbit. In these experiments it was found that whether the animals were kept in a chamber in which the temperature was high or in a very cool chamber, namely, an ice box, made practically no difference in the rate of absorption. This tends to show that there must be some regulating factor counterbalancing the opposite effects of heat and cold. If we now eliminate the thyroid gland innervation by extirpation of the lower cervical ganglion and all the nerves entering it, we observe a marked lengthening of the time taken for absorption of the fluids injected in the lower extremity, a part of the body far removed from all influences of the operation. What is perhaps more suggestive is the fact that now we find a distinct difference in the rate of absorption, depending on whether the animal is in a warm or cold environment. These experiments seem to prove that impulses coming down the sympathetic nerves regulate the intensity of activity of the thyroid gland according to environmental necessities. That the change in the rate of absorption is due to some lack in activity of the thyroid gland after denervation is shown by the control experiment of extirpating the thyroid gland, and of feeding the animal with thyroid gland preparations. In the first case we exaggerate the slowing of absorption and in the second case we can bring up the rate of absorption to an even higher value than in the normal state.

A second method was used to demonstrate the influence of the central nervous system on the activity of the thyroid gland. Experiments which were made

with another object had shown that the primary influence of specific diuretics may be an influence on the central nervous system and on the permeability of the tissue cells injected. Using this fundament, we were able to show that the action of a specific diuretic on diuresis was markedly lowered after denervation of the thyroid gland. The output of water and the output of electrolytes under the same conditions were much less than in the animal when it was in possession of its thyroid gland. Injection of Kendall's thyroxine restored the former activity of specific diuretics.

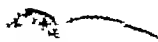
A new method was worked out to demonstrate the influence of thyroxine on the central nervous system. The method consists in recording the frequency of respiration on an animal when it is subjected to gradually raised temperature, between 25 and 35° C. There is a remarkable constancy of the relation between each degree of temperature and the rate of respiration. If we now extirpate the thyroid gland, the curve showing the relation between the temperature and frequency of respiration will lie, in the whole range, very much lower. It is still lower if, besides the thyroid gland, the thymus gland is also extirpated. This method, worked out in the Berne Institute by Dr. Francis Newton, was recently employed to examine the time relations of the first traceable action of thyroxine. In many animals, the first definite symptoms of increased excitability of the respiratory center appeared four hours after intravenous injection of thyroxine, and in all animals they were present after six hours. Not only do these experiments for the first time show that even after as short a time as four hours the influence of thyroxine can become manifest, but they also demonstrate that the central nervous system is very sensitive. This method is, at the same time, one which in a rather short time gives information about the value of a thyroid preparation.

The influence of the thyroid gland on the central nervous system can experimentally be shown by another method, namely, subjecting the animal, in a chamber, to a gradual diminution of barometric pressure. Although in the initial phase the respiration of the normal animal, recorded in one of the usual ways, will rise rapidly, the same animal under the same conditions of initial lowering of barometric pressure will not manifest an increase.

If we are able to find more sensitive nervous mechanisms than that of the respiratory center, it may perhaps be possible to find still shorter periods of first symptoms of activity due to thyroxine.

THE COST OF MEDICAL CARE

The committee on the cost of medical care has now been functioning for over two years, its object being to make in 1932, or as soon thereafter as possible, recommendations, based on the facts which will then have accumulated, for its provision of better medical service for all the people at a reasonable rate to the individual which, at the same time, will give physician, dentist, nurse, hospital and other agents assurance of adequate return. The following studies have been completed



No 1 "The Extent of Illness and of Physical and Mental Defects Prevailing in the United States—a Compilation of Existing Material" It is not the intention of this study to provide new data on the extent of sickness, but to furnish a summary of existing data in convenient form, which will bring the information of the public up to a point from which the committee's own studies will start

No 4 "A Survey of Statistical Data on Medical Facilities in the United States—a Compilation of Existing Material" This study indicates the number and distribution of physicians, dentists, nurses and various other practitioners in the United States as well as the number of institutions and health agencies of various kinds, available for the treatment and prevention of the illnesses and defects described in the earlier study

No 11 "Medical Care for Thirty four Thousand Workers and Their Families—A Survey of the Endicott John Workers Medical Service" The study deals with the medical services of the Endicott Johnson Corporation in New York State It provides a descriptive account of the medical service, together with a discussion of its cost and adequacy Certain features of the medical practice in surrounding communities are compared with those of the Endicott Johnson service

No 18 "Hospital Service for Patients of Moderate Means" This study provides data on the special efforts made by certain hospitals in the United States and Canada providing special facilities and financial adjustments for those patients not accepting or not acceptable for charity service, but who, at the same time, cannot pay the rates usually charged for private service

These studies are under way

No 5 "Surveys of the Medical Services of a Large City, a Small City, and a Rural Community" A study of facilities in Philadelphia was begun in May, 1929 Data being gathered by the Hospital and Health Survey of Philadelphia and several national agencies, together with those made available by the committee's study, will afford a complete picture of all medical and health facilities in one of the largest cities of the country

A study of facilities in Shelby County, Indiana, has also been started

No 5a "Irregular Types of Medical Practice" A little field work has been done on this study in New Orleans, Louisiana It is being conducted through the summer in other parts of the country

No 6 "The Cost of Sickness, during a 12 Months' Period, among Various Representative Population Groups, including the Incidence of Sickness" Ten states and four additional cities have been covered According to present plans complete schedules will be obtained from approximately 10,000 families showing their expenditures for all forms of care in sickness

No 6a "The Cost of Sickness, during a 12 Months' Period, among Policyholders of the Metropolitan Life Insurance Company, including the Incidence of Sickness" This study was inaugurated July 1, 1928, by the Metropolitan Life Insurance Company With the aid of field agents, attractive schedules in the form of calendars were distributed among policyholders The company expects to obtain 100,000 schedules, each covering a period of at least six months

No 9 "Capital Investment and Income in Private Practice" The American Medical Association is carrying on this study, and has already collected a considerable number of returns on income as well as on investment

No 10 "Capital Investment in Hospitals and Clinics" With the aid of a special fund provided by the Rockefeller Foundation, and with the cooperation of the committee, Michael M Davis is conducting this study A professor of accountancy from the University of Chicago has been employed to have immediate charge of it

No 10b "Bases for Financial Adjustments among Hospital Patients" Visits are now being made among approximately 25 sample hospitals which are attempting to provide financial adjustments for persons of moderate means

Studies Being Planned for the Near Future

No 5b "The Service of Pharmacy" A committee of the National Drug Trade Conference has been appointed to cooperate with the Committee on the Cost of Medical Care in conducting this study It is also possible that the aid of the Bureau of the Census may be available

No 5c "The Organization of Medicine from a Functional Point of View" This study will be a collaboration by a physician and an economist.

No 9a "Capital Investment and Income of Dentists in Private Practice" Following the example of the American Medical Association, it is hoped that the American Dental Association may undertake a study of capital investment and income among dentists A special committee of the American Dental Association has been appointed to cooperate

No 17 "Existing Applications of the Insurance Principle to Illness and Accident in the United States" The plan for this study has been completed It is hoped that an interested organization may be induced to supply part of the funds for this study and that another research agency may agree to undertake the work

In addition to the above studies completed or under way it is proposed to take up in addition the following

2 The prevalence of certain disorders which appear to be among the most serious causes of disability and inefficiency

3 The proportion of persons, both adults and school children, not disabled, who are in need of medical service

6b The cost of living in the United States, including detailed information regarding expenditures for medical services

6c The total cost of disease in the United States

7 The influence of specialization on the cost of medical service

8 The cost of adequate medical service for a family during a 12 months' period.

10a The relation between charges made to patients in hospitals and the actual cost of their care

11a Organized medical service in the United States Army

12 Pay clinics and group clinics

13 Recent developments in services rendered to persons not indigent by state, municipal, and county hospitals

14 Visiting nurse societies

15 School health service

16 The extent of private medical service on a yearly basis

THE PAN PACIFIC SURGICAL CONFERENCE

Dr Charles D Lockwood, of Pasadena, California, has kindly supplied me with the following information in regard to the Pan Pacific Surgical Conference at which he read his address printed in this issue of the CLINICS

The Pan Pacific Surgical Conference which was held in Honolulu from August 14th 24th, 1929, was the first meeting of its kind. It was sponsored by the Pan Pacific Union, an organization having its headquarters in Honolulu, and whose purpose is to bring about a spirit of good fellowship among the nations bordering on the Pacific. The Pan Pacific Union has already held successful conferences of leaders from the Countries of the Pacific on the subjects of Science, Education, The Fisheries, Social Service and International Peace

The program for the Pan Pacific Surgical Conference was limited to surgical subjects and was one of the most comprehensive programs ever presented. The delegates, to the number of two hundred, represented most of the important countries bordering on the Pacific. While the majority of the delegates were from the western coast of the United States, there were one or more delegates from China, Japan, Korea, Chili, Peru, New Zealand, Australia, and Central America

The most outstanding delegates were those from China, Japan, Australia, and New Zealand. Dr Makoto Saito from Nagoya, Japan, presented a remarkable paper on "Brain Surgery," illustrated by moving pictures, he also presented some very original work on the "Circulation of the Brain, Studied after Injection of Lipiodol through the Superior Thyroid Arteries." Sir William A. Osborne, professor of Physiology and Dean of the Medical Department of the University of Melbourne, Australia, gave a very interesting address on "The Relation of Physiology to Surgery." Dr Norman Royale of Sydney, Australia presented two original papers, one on "Tendon Transplantation with Autoplastic Tendon Suture," the other a study of "Muscle Tone following Stimulation of the Sympathetic Nervous System"

Dr S. Harry Harris, of Sydney, Australia, presented a motion picture demonstrating his "Technique for Supra pubic Prostatectomy with Complete Closure," he employs a special probang needle with which he introduces hemostatic sutures and reconstructs the trigone

On the whole the Australian Delegation was the most impressive, and their work was highly original. A permanent organization was formed at the conclusion of the Conference, and it was decided to have another Pan Pacific Surgical Conference in three years at Honolulu

PHARMACY IN GREAT BRITAIN*

As in the United States, in Great Britain retail pharmacy is partly in the hands of the independent man and partly in the hands of the chain stores. Up to a few years ago the chain stores, such as Boots and Taylors Drug Company, were extending their activities

* The Editor is indebted to Mr Hugh N Linstead, Secretary and Registrar of the Pharmaceutical Society of Great Britain for the information contained in this article

very rapidly, and at one time Boots were said to be opening a new store in some part of the country every week. This expansion has now to some extent stopped and they appear to be giving more attention to the consolidation of their position. The individual retailer in fact is likely to find himself less and less in direct competition with the chain stores as these are finding it profitable to extend their interests and to become departmental stores rather than drug stores. Another development in connection with retail pharmacy associated with the chain stores is the buying up of existing chemists' shops by syndicates. There are at least three of these syndicates operating and it is probable that between them during the last year or two they have either bought or taken options upon six or seven hundred businesses. This movement again has come to a temporary stop, which may mean that the syndicates are now negotiating among themselves for further amalgamations. In any case the fact that these movements are taking place is clear evidence of one thing which is very obvious, namely, that the retail drug trade in Great Britain at the present moment is a reasonably profitable occupation. It is true that there is not much restricted by law to the qualified man and that unqualified competition in some parts of the country is severe, yet it is partly for this very reason that the pharmacist is making his business pay. So little pharmacy is to be done in many of the shops that the proprietors have been compelled to turn their attention to side lines for their profits. While the average drug store in England has not its soft drink bar, its candy counter or its cigar counter, yet photography, wireless stationery and leather goods are all proving themselves to be profitable side lines. Although, therefore, the retail pharmacist finds himself reasonably prosperous it is not on account of the pharmacy that he does which in many cases is not an inducement to bring customers to the shop.

The general control of pharmacy in Great Britain is in the hands of the Pharmaceutical Society, which has its headquarters at 17 Bloomsbury Square. The Society represents a continuation of the old guilds, for its functions include both the protection of the interests of its members and also their education and examination. A boy or girl wishing to enter pharmacy begins during his or her school life by passing one of the numerous preliminary examinations

accepted by the Society, usually either the School Certificate Examination of the Board of Education or a University Matriculation Examination. Having this he is entitled to be registered as an apprentice or student and to commence his apprenticeship. He leaves school normally at sixteen or seventeen and may then either commence a course of study approved by the Society for the preliminary scientific examination (chemistry, physics and botany) or may at once commence his apprenticeship. It is becoming more and more general for the preliminary scientific examination to be taken before the apprenticeship is commenced, and the approved course of instruction extends over a year. The student is therefore examined when he is about eighteen and if he is successful commences an apprenticeship which must last for a minimum of two years and often lasts for three or four. During this time the apprentice is bound by indentures to his master, and a copy of the indentures is registered with the Society which has therefore complete information of all the pharmaceutical students throughout the country. During his apprenticeship the apprentice receives instruction in the compounding and dispensing of medicines and he probably at the same time obtains a good working knowledge of the practical requirements of the laws affecting a chemist's business. After completing his apprenticeship the student goes to an approved school of pharmacy, of which there are twenty-five in England and Scotland, and there attends another course of study approved by the Pharmaceutical Society, which extends over at least one academic year. At the conclusion of this course of study he takes the chemist and druggist qualifying examination which is conducted by the Society, and on passing that he is entitled to be registered by the Society as a chemist and druggist and to practice pharmacy. A two-year course can also be taken after the preliminary scientific examination has been passed, leading to the pharmaceutical chemist qualifying examination, or where a student has passed a university intermediate examination, to a university degree in pharmacy. Three universities grant such a degree—Glasgow, London and Manchester—and graduates are entitled to be registered after passing an examination in poison law conducted by the Pharmaceutical Society.

The Society's house at Bloomsbury Square is the centre of most of the pharmaceutical activities of Great Britain. In addition to the

administrative offices of the Society there is a library of some 18,000 volumes, a museum containing a unique collection of *materia medica*, the School of Pharmacy of the University of London, the examination laboratories used for the qualifying examinations, and also the Pharmacological Laboratories in which drugs which cannot be tested by chemical means are tested biologically, both by way of research and for manufacturers who have not opportunities of testing their products themselves. Among the research work carried out by the Pharmacological Laboratories has been an investigation on behalf of the Department of Biological Standards of the Medical Research Council into the relative potency of samples of *digitalis* leaf. This has been extended to comparisons between the results of examining a series of *digitalis* tinctures by the cat method with the results obtained on patients, and also by a comparison of the results of an examination by the cat method with an examination by the frog method. It has been found that there is promising agreement between the first class of comparisons but that between the second class there is no such agreement, which leads to difficulties in the way of accepting one or other of these methods as suitable for an international method. Early in its work (in 1926) the Laboratories determined a suitable standard for *strophanthus* in terms of ouabain, which it is hoped will be found acceptable as an international standard. The Laboratories have also done a great deal of work on liquid extract of ergot. It has been found that of all the different pharmacopœial extracts examined, only those of the United States and of the Dutch pharmacopœias retain the specific activity originally present in the ergot, and that the liquid extract of the British Pharmacopœia, which is made with an alkaline menstruum, has practically no activity. Investigations directed to find the most active and stable form of extract have shown that the better way would appear to be the preparation of an extract after defatting the ergot by percolating with a menstruum similar to that given in the United States Pharmacopœia, using two parts of menstruum to one part of drug. It has been found that only one extraction is necessary, the second extraction laid down in the United States Pharmacopœia being found to contain only a negligible proportion of activity. The Laboratories have also worked upon a standard for squill and for primary ex-

tract Other work includes an investigation of the relation of the ovarian hormone to the mechanism of labor, clinical observations on oxytocic and vasopressin confirming the work of Kamm and Aldrich, in the laboratories of Messrs Parke, Davis & Co, investigations of the anti-diuretic activity of pituitary extract, and of the variation in different commercial samples of strophanthin In the Nutrition Department considerable work has been done upon the establishment of standards for preparations containing vitamins The Second Annual Report of the Laboratories in 1927 pointed out that the unit adopted in the United States Pharmacopœia X, expressed in terms of an animal reaction, for vitamin A present in cod-liver oil, is a unit which must show great variations and the definition does not represent an amount of activity present in a given weight of a stable standard and is to that extent unscientific. For the testing of vitamin D McCollum's line test has been used It has been shown that the results obtained by the line test and by taking X-ray photographs of the bones were sane, and that test has accordingly been adopted for use in the Laboratories Subsequent work has been directed toward obtaining a standard for vitamin D in terms of irradiated ergosterol It has been found that this is practicable and that a unit of activity can be defined as the amount of activity present in 0.0001 milligram of a standard solution of irradiated ergosterol During 1928 the total number of samples received, for which fees were paid, in the Laboratories was 156, made up principally of pituitary, digitalis, squill and ergot, in the Nutrition Department 184 samples were received, principally for testing for vitamins A, B and D

The Pharmacological Laboratories are situated in one of the newer parts of the buildings, but at present the School of Pharmacy is housed in an older part It is, however, understood that its removal before many years is projected In addition to dispensaries and a chemical laboratory, it contains an exceedingly well-equipped laboratory for pharmacognostical investigations, to which is attached a research laboratory Chemical and pharmacognostical research for the degree of Ph.D. of the University of London is regularly carried out, and the students at present in the laboratories include two from Columbia University, New York City

DOCTOR WILLIAM BEAUMONT A BACKWOOD PHYSIOLOGIST

Some of the members of the Thirteenth International Physiological Congress did well to visit the monument¹ erected to the memory of William Beaumont

Come with Doctor Osler² for a few moments on that lovely day of June 6th in 1822, to what were then far-off northern wilds, to the Island of Michilimacinae, where the waters of Lake Michigan and Lake Huron unite and where stands Fort Mackinac, rich in the memories of Indian and voyageur, one of the four important posts on the upper lakes in the days when the rose and the fleur-de-lis strove for the mastery of the western world. Here the noble Marquette labored for his Lord, and here beneath the chapel of St Ignace they laid his bones to rest. Here the intrepid La Salle, the brave Tonty and the resolute Du Luht had halted in their wild wanderings. Its palisades and block-houses had echoed the war whoops of Ojibwas and Ottawas, of Hurons and Iroquois, and the old fort had been the scene of bloody massacres and hard fought fights, but at the conclusion of the War of 1812, after two centuries of struggle, peace settled at last on the island. The fort was occupied by United States troops, who kept the Indians in check and did general police duty on the frontier, and the place had become a rendezvous for Indians and voyageurs in the employ of the American Fur Company. On this bright springlike morning the village presented an animated scene. The annual return tide to the trading post was in full course, and the beach was thronged with canoes and batteaux laden with the pelts of the winter's hunt. Voyageurs and Indians, men, women, and children, with here and there a few soldiers, made up a motley crowd. Suddenly from the company's store there is the loud report of a gun, and amid the confusion and excitement the rumor spreads of an accident, and there is a hurrying of messengers to the barracks for a doctor. In a few minutes an alert looking man in the uniform of a U S Army surgeon made his way through the crowd, and was at the side of a young French Canadian (Alexis St Martin) who had been wounded by the accidental discharge of a shotgun, and with a composure bred of an exceptional experience of such injuries, prepared to make the examination, which showed a wound just under the left breast, and a perforation directly into the cavity of the stomach through which food was escaping. Though youthful in appearance, surgeon William Beaumont had seen much service, and at the capture of York and at the investment of Plattsburgh he had shown a coolness and bravery under fire which had won high praise from his superior officers. The man and the opportunity had met—the outcome being a wonderful and epoch making series of physiological experiments carried on for many years concerning the gastric functions, and in 1833 published a book of 288 pages under the title of "Experiments and Observations on the Gastric Juice and the

¹ A photograph of the monument appears in the October, 1929, issue of *Hygeia*.

² Adapted from portion of an address before the St. Louis Medical Society, October 4, 1902, and quoted in part in Cushing's "Life of Sir William Osler," pp 591-2

Physiology of Digestion" One of the things that Osler failed in doing, while trying his best, was to make a post-mortem on St. Martin when he died, though he left his own brain to the Wistar Institute of Philadelphia

Here are two characteristic oslerian letters, the first written in reply to one of mine in 1902 asking for his promised article for publication in the INTERNATIONAL CLINICS¹ and the second, in 1888 for my not more promptly handing in some abstracts of cases from the records of the Infirmary for Nervous Diseases at Philadelphia

P.S. Just home.

1 WEST FRANKLIN ST.

21st.

Dear Cattell

Skinner - mea
cuppa! peccavi! & have come.
Short - very short - but I have
forgiven me. I am deep in an
address in Heartmount yesterday
forenoon & shall not have a moment
for anything extra for some weeks
from now

(Undated, probably Summer of 1888)

Dear Cattell

Excuse this plaguing—but I am down for lectures in E [epilepsy, cerebral palsies] in children and wish to go over the Records—as soon as possible

(Signed) Wm Osler

How one's life may be changed by little things if I had completed this work for Doctor Osler from the records of the Infirmary for

¹ The article was subsequently published in the first volume of the next year's series 1903 of the INTERNATIONAL CLINICS under the editorship of my successor and appointee, Dr A. O J Kelly, and was entitled, "Aneurism of the descending thoracic aorta" In this number Doctor Osler became for the first time one of the contributing editors, which place he held until the time of his death in 1919, under the editorship of Dr H. R. M. Landis

Nervous Diseases instead of paying Dr J Allison Scott, in the early 'nineties my assistant in the teaching of morbid anatomy at the University of Pennsylvania, to finish them, I might have become a resident physician under Lafleur instead of Scott or Toulmin when the organization of the medical department of Johns Hopkins Hospital and Medical School took place a year later, and thus have ended my days as a clinician instead of in the more congenial position of a medical editor And still another chance came later on when Dr William Pepper asked me to become his office assistant, a place vacated by Dr Judson Daland, the first editor of the *INTERNATIONAL CLINICS*, and taken by Dr Alfred Stengel, now Professor of Medicine in the University of Pennsylvania Of Doctor Pepper and the period in which he lived I shall have much to write about later on from my own personal knowledge

EUGENIC STERILIZATION

At a recent meeting of the Delaware County Medical Society held at Elwyn, Pennsylvania, Dr E A. Whitney, of the State Institution for Feeble-Minded Children, made some interesting observations on eugenic sterilization, basing his remarks on a careful study of the asexualization of 133 males and the sterilization of 129 females of the Elwyn Training School, of which number thirty-one are reported on in detail for the first time As the 1920 census estimated that there were 656,000 mental defectives in this country of whom only about 75,000 were receiving supervised care, the necessity of controlling the situation would seem to require at the present time more careful consideration, and the result of the coming census in 1930 will be looked forward to with interest as those who know prognosticate that the number of defectives will have materially increased over that of the last census

There is no law in Pennsylvania which will permit sterilization The cases reported by Whitney were done at the request of parents or guardians, and are listed under three types of operative procedures, namely, vasectomy, castration, and salpingo-oophorectomy The chief reasons for operating were sexual perversion, obscene habits, excessive nervousness, and mental retrogression

Puberty, or shortly thereafter, is the best age at which to perform sterilization. Pre-adolescent operations are, as a rule, more

difficult because of lack of development of the sex organs. In this series, the youngest male operated upon was 12, the oldest 31, and the average age was 18. Of the females, the youngest was 13, the oldest 39, and the average 23.

While it is difficult to estimate results in the comparatively short period of time since these operations were performed, Whitney appears to be more than satisfied with the results.

Vasectomized boys may, and do, masturbate, but the desire grows less as time goes on, until in most cases it entirely ceases. The time required for the cessation varies from six months to three or more years, and with the cessation of evil habits, there is often a quickening of the mental faculties with changes in disposition and behavior for the better. In the castrated cases, the changes are usually more rapid. If there is any serious effect on the health from the sudden removal of the internal secretion of the testicle, it has escaped Whitney's notice, and he believes the operation to be in no way harmful. Also, he had little or no trouble with the female patients after having established an artificial menopause.

The habits of nine of the eleven vasectomized boys have improved (81 per cent). The habits of eight of the nine castrated, or 80 per cent, show improvement. The habits of six, or 54.5 per cent of the girls show improvement. It would seem from this that it takes a longer period for improvement to manifest itself in girls. Considering the group of thirty-one as a whole, 70.8 per cent. showed improvement.

From the standpoint of the effect of sterilization on the nervous system, in this series of cases, the writer found improvement in seven of the eleven vasectomized boys, or 63.6 per cent improved. Five of the nine castrated, or 55.5 per cent, showed improvement. In the girls, only three of the eleven cases, or 27.2 per cent, showed improvement. Considering the group as a whole, there was improvement in 48.7 per cent.

In a school for the feeble-minded one is greatly interested in the effect of sterilization on the mentality of the patients. In general, Whitney found those operated upon are much more tractable, more gentle, more docile, with fewer outbursts of temper, and on the whole much happier of disposition. In the comparatively short period

of time since the operations, twelve of the thirty-one, or 38.7 per cent., show improvement mentally

As to the present-day legal status of eugenic sterilization Whitney states

Twenty three states have legislation in its favor. In three of those states now having statutes in its favor, earlier attempts at legalized eugenic sterilization had been vetoed. In twenty three states the matter has not been brought before the legislature. In three states, one of which is Pennsylvania, the matter has been brought before the legislators and has never passed successfully, either through defeat in the legislative assembly or through veto.

The constitutionality of such laws has been widely discussed. Earlier opinions, such as those of the Federal District Court of Nevada in 1918, held the Nevada laws to be unconstitutional.

The State Supreme Court of Michigan held that its first statute of 1913 was unconstitutional. The second statute of 1923 was held to be constitutional, and under it sterilizations are being performed. The New Jersey statute of 1911 was held to be unconstitutional, and no operations were performed under it. The Supreme Court of Appeals of Virginia in 1925 upheld the constitutionality of legalized eugenic sterilization. This decision of that court has been widely read and generally approved.

The part that our Federal Government plays in laws concerning eugenic sterilization at the present time is only to hold that such laws are the function of the several states rather than of the Federal Government. However, if eugenic sterilization becomes a national policy by the states, the Federal Government will have to collaborate by providing for sterilization of (1) Those immigrants who may be personally eligible for admission but whose family stock standards are such that they would be considered potential parents of socially inadequate offspring. (2) All persons below the standard of parenthood as set forth in model state laws, who are beyond the jurisdiction of those state laws, such as the inhabitants of the District of Columbia, our territories, inmates of federal institutions, soldiers, and sailors.

To my mind, the prevention of feeble mindedness is just as much a part of preventive medicine as is the prevention of smallpox or diphtheria. Not only should we in each state seek to prevent the feeble minded from reproducing their kind, but as a nation we should not admit the feeble-minded into our land. In this small group of thirty-one cases, one was foreign born and thirty were native born, yet the parents (one or both) in fifteen cases, or 48 per cent., were foreign born and should never have been admitted to our shores.

Considering this further, we find that 12.9 per cent. of our total population are foreign born, whereas, 15.5 per cent. of the inmates of 684 state and federal institutions are foreign born. We are in need of more rigid investigation as to the mentality of those who seek to come to our land.

THE NEW AND THE OLD IN BOOKS

THE QUARTERLY CUMULATIVE INDEX MEDICUS

The *Index Medicus* is again passing through one of its decennial phases of readjustment to its environment to which I am so

familiar from the 'nineties of the last century, and our own suggestion, as much as we regret to make it, is that the quarterly character of the present *Cumulative Index Medicus* be dropped, and that this most valuable of all medical publications be issued semiannually on the designated date of appearing. The cost of publishing the *Index* has increased so rapidly and the danger of the Carnegie Institute of Washington withdrawing its large annual grant of money toward the running expenses, are so great that the suggestion of Dr. Frank Billings, of Chicago, to secure an endowment would seem to be the easiest way yet suggested and the quickest of accomplishment in order to supply the money to take care of the yearly deficit. The impossibility of indexing all medical journals and of every article in the periodicals indexed, is axiomatic, but the American Medical Association would appear to be in error in not consulting more extensively the wishes of the New York Academy of Medicine and other institutions of like character as to which journals are to be indexed and how this is to be done. It is reported that when the third series of the *Index Catalogue* of the Surgeon's General office of the United States Army is completed that this publication will be superseded by an annual volume. If this be true, another complication will be added to the difficulty-complex of the present situation. Very few public libraries and only the best of the public libraries possess all of the original volumes of the first and second series of the *Index Medicus*, but your *Editor* of the *INTERNATIONAL CLINICS* is one of the fortunate ones in having these volumes under his present control as he writes this note at 3 30 A.M. on November 20, 1929, in order that the last volume of the thirty-ninth series of the present year may appear promptly on time during the first week of December.

DEVILS, DRUGS AND DOCTORS

Under the misleading, alliterative title of "Devils, Drugs and Doctors" Dr. Howard W. Haggard, Associate Professor of Applied Physiology in Yale University, and Harper and Brothers have given us a well-illustrated and printed book of over four hundred pages, filled with odds and ends of useful and useless information of the most diverse character. After thumbing the book and recalling the well-known lines

"The Devil was sick, the Devil a monk would be
The Devil was well, the Devil of a monk was he"

it would be instructive to know the character of medical treatment taken by Doctor Haggard when he is ill

Professor Haggard is evidently pessimistic as to the future of the medical sciences which "today have given to the world the healthiest period it has ever known" for "the danger to the scientific spirit, to the advance of medicine, and to the integrity of civilization does not come from the masses of unthinking people. This danger comes from intelligent people who play a part in shaping civilization but who have not been educated to think rationally, it comes from sentimental and idle people in whom the primitive instinct escapes from repression and rises to prevent thought. They revive the religious healing cults of the primitive peoples, but with modernized form and terminology, or they join forces with the antivivisectionists and revel in its contemplation of cruelties which exist only in their imaginations. Medicine and civilization advance and regress together. The conditions essential to advance are intellectual courage and a true love for humanity. It is as true today as always in the past that further advance or even the holding of what has already been won depends upon the extent to which intellectual courage and humanity prevail against bigotry and obscurantism."

Lovers of Dickens will read with interest of the close association of theriac with treacle

"Mithridates was versed in the Greek medicine of Egypt and undertook his pharmacological experiments to find a universal antidote against poison. His attention centered largely on snake venoms, but he employed men to search throughout the known world to find poisonous substances of all kinds. These he administered to slaves, studying the effects and trying to find an antidote. After his death his recipe was discovered. This compound was known as *mithridaticum* and with some variations in the hands of later physicians was developed into *theriac*. In subsequent times *theriac* was more extensively employed than any other medicinal remedy. It contained from thirty seven to sixty three ingredients, all of which are worthless as remedies. The main ingredient of the compound was the flesh of vipers. The viper is a poisonous snake, but like all snakes, it has immunity to its own venom, therefore, by the process of early medical reasoning, it was supposed to confer this immunity upon people who took it as a drug. *Theriac* was used as a cure all even up to a hundred years ago. It was taken internally in the treatment of all diseases, and applied externally in the treatment of all wounds. During the Renaissance the preparation of *theriac* was an elaborate official affair carried out under the supervision of city officials to prevent adulteration. Eventually *theriac* became known as *treacle*, and when *theriac* was

ady

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was applied to molasses. The treacle and molasses administered to all young people a generation or two ago as a spring tonic was derived from the old belief in theriac."

The book is marred by unnecessary slurs as "The character of Luther bears no stigma on this score [being a drunkard], yet his habits were in some respects no better than those of Paracelsus."

EDITORIAL POLICY OF THE INTERNATIONAL CLINICS FOR 1930

The long established editorial policy of only publishing requested contributions in the pages of the INTERNATIONAL CLINICS will be continued during 1930, and it is to be hoped that Professor Lewellys F. Barker, of Baltimore, will be able to open the first volume of the fortieth series with one or more of his excellent clinical lectures. As far as can be ascertained the new departments of Medical Questionnaires and Medical Trend have been received with manifest approval, and it is hoped that subscribers will write the Editor frankly as to the kind of material that they would like to see commented upon and written about. From one-third to one-half of each issue is devoted to the Department of Diagnosis and Treatment of the various diseases covered by the Bertillon Classification, both from the standpoint of mortality and morbidity, and the especial subject for consideration in the next issue will be typhoid fever which is again bobbing up its ugly head as the politicians become lax. In each volume, as has been done in the last several numbers, an institution, hospital, a medical school, or a city will be personally visited and a symposium arranged for or the work going on there described. It is intended to make the reading matter conform to present-day conditions of practice as it exists, and the cost of medical care and the methods of securing an adequate income derived from the professional practice of the physician, will be given most careful consideration.

CUMULATIVE INDEX

(THIRTY-NINTH SERIES, VOLS I, II, III, AND IV—1929)

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